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BUTTER-BOXES AND MOULD-GROWTH.

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MOULD-GROWTH on the surface of stored butter is unattractive to the buyer and injurious to the butter. It has been shown by several investigators that mould fungi can grow well on the surface of both salted and unsalted butter, and Vernon(1) has demonstrated that they may develop in the interior of unsalted butter, although generally they are limited to the surface layer of salted butter. Surface mould seldom makes its appearance until stored butter has been defrosted. The origin and control of mould is therefore of great importance to manufacturers of butter, especially in countries (such as New Zealand and Australia) distant from their principal markets, because butter made over a considerable period may be affected before this happening becomes known to the makers.

The sources of infection have been variously attributed to butter-boxes, parchment, and aerial contamination of the butter during manufacture. Vernon(1) has shown that butter-box timber and parchment-paper can be the source of moulds and can support mould-growth. Neill(2) has confirmed Vernon's observations with regard to timber, and he has also shown that the treatment of timber with a solution of the sodium salt of salicylanilide, sold under the trade name of "Shirlan W. S." is effective in preventing mould-growth on butter-box timber.

The part played by butter-boxes is of great significance to the New Zealand butter industry. Three types of boxes—viz., standard, sub-standard, and sawn-timber Saranac (wire-bound)—are used for exporting butter. The design of each is defined in the New Zealand Dairy Regulations(3). Until recently Saranac boxes made of rotary-cut timber were also employed, but their export has been prohibited since 1st January, 1936. The first three named boxes are made of sawn timber, which may be either air-dried or kiln-dried. Rotary-cut timber differs radically from the sawn in two respects. Prior to peeling, the logs are subjected to a treatment with high-pressure steam which enables the knife to shear off the cut timber in "peelings" of any desired thickness. The peeled timber is then straightened by passing the pieces between hot rollers, being dried to a definite moisture content. The timber is next cut into required sizes and assembled into wire-bound boxes. The economy of this process by the elimination of saw-dust is obvious.

In addition to differing in design, the boxes differ in the thickness of timber employed in their construction. The ends of both the standard and sub-standard box are made of timber $\frac{5}{8}$ in. in thickness. The sides, top, and bottom of the standard are made of $\frac{1}{2}$ in. timber, while the corresponding parts of the sub-standard are made of $\frac{3}{8}$ in. The ends, sides, top, and bottom of the Saranac wire-bound box are made of $\frac{1}{4}$ in. timber.

White-pine timber is most extensively used, but silver-beech and Swedish pine, impregnated with wax, are also employed.

EXPERIMENTAL.

The following two series of experiments were carried out to determine (*a*) the relative resistance of different types of butter-boxes to mould-growth; (*b*) the effect of heavy infection of box-timber with mould spores; (*c*) the extent of damage caused by surface mould; and (*d*) the practicability of protecting butter from mould-growth originating from the box.

In the first series, objectives (*a*), (*b*), and (*c*) were studied. The second was undertaken to provide confirmatory evidence of the first and to test on a semi-commercial scale the effectiveness as a fungicide of Shirlan W. S.

Fifty-six-pound boxes of the various types under trial were packed with salted butter at a nearby butter-factory. They were then held in cold storage at 13° F. for nine days, and, after being defrosted in a room kept at an average temperature of 68° F. and from 85 per cent. to 90 per cent. relative humidity for a period of a week, were examined individually for mould-growth. Prior to being stacked for defrosting, each box was dropped several times from a height of about 3 ft. to the floor to simulate handling in transit. This treatment caused the sides of some of the boxes to "spring" from the ends. Care was taken in stacking the boxes to expose all types to approximately the same conditions.

FIRST SERIES.

Seventeen boxes were employed, five being standard, two sub-standard, five Saranac made of sawn timber, and five Saranac made of rotary-cut timber. Prior to being filled with butter, two of each of the standard, sawn Saranac, and rotary-cut Saranac types, and one sub-standard, were sprayed inside and outside with a mixed suspension of spores from pure cultures of *Pullaria pullulans*, *Cladosporium herbarum*, and *Penicillium expansum*, and thereafter lined with a double fold of 28/30 lb. parchment-paper. One standard, one sawn Saranac, and one rotary-cut Saranac were first similarly infected with mould spores and thereafter lined with parchment-paper, also sprayed with the same suspension of mould spores. The remaining boxes were not artificially infected.

The boxes were filled with salted butter, stored, defrosted, "dumped," and examined as described above.

RESULTS.

(*a*) *Non-infected Boxes.*—The standard and sub-standard boxes were free from visible mould-growth. Black-spot (*Cladosporium*) and green-mould (*Penicillium*) developed in scattered areas on the outside and inside of the sawn Saranac boxes, on the parchment lining, and on

parts of the surface of the butter. Internal mould-growth was most prolific at those points at which the sides had "sprung" from the cleats of the boxes.

The rotary-cut Saranac boxes showed much heavier mould-growth, the exterior, interior, and parchment-paper all being affected. A little mould penetrated to the surface of the butter. The predominating moulds were *Cladosporium*, *Penicillium*, *Mucor*, and a red staining type. As in the case of the sawn-timber box, mould-growth was most profuse in areas adjacent to openings between the sides and ends.

A significant feature of the mould on both types of Saranac box was its dense growth on panels made of soft, sappy timber, those made of heart timber being comparatively unaffected.

FIG. 1. INNER SURFACE OF SIDE OF SUB-STANDARD WHITE-PINE BOX, SHOWING MOULDING ADJACENT TO SEAM.

[*Photo by H. J. Drake.*

(*b*) *Infected Boxes.*—As was to be expected, all of the inoculated boxes developed more mould-growth than the non-inoculated, the intensity of infection varying with the type of box. That on the standard and sub-standard was limited to areas adjoining seams (Fig. 1) in the sides of the box; no mould penetrated to the surface of the butter at these places. The sawn Saranac boxes showed more extensive growth of mould on the exterior and interior and on the parchment-paper, especially at the seams and edges. Some mould penetrated to the butter. The rotary-cut Saranac boxes were even more extensively

covered with moulds, as also was the surface of the butter. In all cases *Pullaria* predominated, but the *Cladosporium* and *Penicillium* were also present. Boxes lined with infected parchment developed no more mould than those not so treated. Furthermore, no mould developed from infected parchment under those parts of boxes not affected with mould-growth.

Second Series.

The same types of boxes were employed, with the addition of (*a*) standard and sub-standard boxes made of Swedish pine and (*b*) sawn Saranac boxes made of $\frac{3}{8}$ in. white-pine. Provision was also made to investigate the possibility of preventing the growth of mould on the boxes by treating them with a solution in water of sodium salicylanilide (Shirlan W. S.), and to determine whether a lining-material made of aluminium foil sandwiched between two sheets of parchment-paper would prevent mould from penetrating to the surface of butter from badly-infected timber. It has already been shown that this latter material prevents the development of surface yellow colour on butter by avoiding the evaporation of moisture(4).

In all there were used sixty boxes, treated as follows:—

Type of Box.	Non-infected.		Artificially infected.		
	Control.	Shirlan-treated.	Untreated.	Shirlan-treated.	Untreated and packed with Foil-parchment.
Standard white-pine ..	2	2	2	2	2
Sub-standard white-pine ..	2	2	2	2	2
Sawn Saranac white-pine ..	2	2	2	2	2
Rotary white-pine ..	2	2	2	2	2
Sawn Saranac $\frac{3}{8}$ in. white-pine	2	2	2	2	2
Standard Swedish pine ..	2	2	2	2	2
Sub-standard Swedish pine..	1	..	1	2	1

The ten Swedish pine standard boxes were impregnated with wax, while four of the sub-standard were not waxed. The Shirlan-treated boxes were immersed in 0·1 per cent. solution of Shirlan W. S. for ten minutes, the standard and sub-standard boxes being treated in the shook, and the Saranac type in the wire-bound but open state. Subsequent to treatment, the boxes were air-dried. The infected boxes were sprayed with a suspension of mould spores as in Series 1, the Shirlan-treated boxes being sprayed subsequent to treatment. The parchment was not sprayed. The boxes were packed with salted butter, stored, "dumped," and defrosted in the same way as the first series. As in Series 1, the sides of several of the $\frac{1}{4}$ in. Saranac boxes sprang from their ends whilst being "dumped." The $\frac{3}{8}$ in. Saranac boxes remained intact. Some of the standard and sub-standard boxes had split sides—see plates 2 to 4. There was no visible appearance of mould-growth on any of the boxes prior to storage nor on immediate removal from the cold store.

RESULTS.

The following table shows the relative extent of mould-growth observed in the various butter-boxes :—

TABULAR PRESENTATION OF RESULTS OF EXAMINATION OF BUTTER-BOXES.

(Degree of Visible Moulding indicated by Number of Crosses.)

Description.	Untreated Control.	Treated Shirlan.	Untreated inoculated.	Treated Shirlan inoculated.	Untreated inoculated packed Foil.
Standard white-pine ..	x	o	x	x	xxx
,, ..	x	o	xx	x	xx
Sub-standard white-pine ..	xx	o	x	x	xx
,, ..	xx	o	xx	x	xxx
Sawn Saranac ¼ in. white-pine	x	o	xxx	x	xxx
,,	xx	x	xxxx	x	xxx
Rotary-cut Saranac ¼ in. white-pine	xxxx	o	xxxx	x	xxxxx
Ditto	xxxxx	xx	xxxx	xx	xxxxx
Sawn Saranac ⅜ in. white-pine	x	o	x	x	xx
,,	x	o	x	x	xx
Swedish standard waxed ..	o	o	x	o	x
,, ..	o	o	x	x	o
Swedish sub-standard waxed	o	..	o	o	o
,,	..	..	x	..	..

The non-infected standard (Fig. 2) and ⅜ in. Saranac (Fig. 4) white-pine boxes developed only a small amount of mould-growth which did no material damage to the butter. The sub-standard (Fig. 2) and ¼ in. sawn Saranac (Fig. 3) developed more extensive growth, which penetrated to the butter near openings in the boxes. In several cases more mould was observed inside the box than on the exterior. The untreated rotary-cut Saranac boxes were heavily covered with mould, and in the stack stood out clearly from the others (Figs. 3 and 4).

The untreated Swedish-timber boxes were quite free of mould-growth (Fig. 5). Infection of the timber with mould spores accentuated the degree of moulding in all cases previously affected and induced mould-growth on some of the Swedish boxes. The growth on the inoculated boxes was general, while that on the non-inoculated was localized (Fig. 7). The non-infected Shirlan-treated boxes were free from mould with the exception of a very little on two rotary-cut cases, those artificially infected following treatment showing a little more. Chemical examination of the surface of butter packed in Shirlan-treated boxes showed no evidence of salicylanilide. The foil-parchment was effective in preventing mould-growth from penetrating to the surface of the butter, even from the most heavily-infected boxes (Fig. 6). Extensive damage was caused to the surface of butter to which mould penetrated through the parchment from the interior surface of boxes (Fig. 7).

As in the first series of experiments, growth was most extensive in areas adjacent to openings in the box. In some cases profuse growth extended from openings caused by "sprung" ends of Saranac boxes and spread over the whole of the interior sides. It was again observed

in this series of experiments that boards taken from "heart" close-texture timbers were much less subject to mould-growth than those from sappy, soft-texture timber (Fig. 6). Whilst the Swedish-pine boxes were superior to those made of untreated white-pine in their resistance to mould-growth, they imparted a definitely undesirable wood taint to the surface of the butter.

FIG. 2.

Left stack, sub-standard white-pine; right stack, standard white-pine. Top tier of both stacks infected, treated. Second tier of both stacks infected, untreated. Third tier of both stacks not infected, treated. Bottom tier of both stacks not infected, untreated.

[Photo by H. J. Drake.

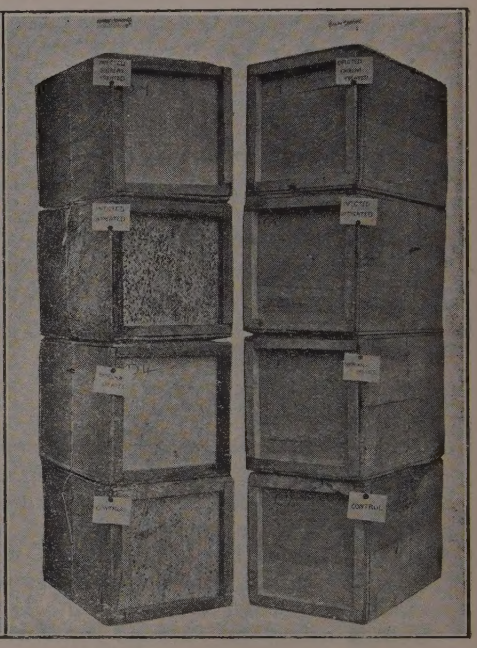

FIG. 3.

Left stack, rotary-cut Saranac 1¼ in.; right stack, sawn Saranac 1¼ in. Top tier: Infected, treated. Second tier: Infected, untreated. Third tier: Not infected, treated. Bottom tier: Not infected, untreated.

[Photo by H. J. Drake.

Discussion.

It has been clearly shown that butter-box timber is a source of mould-infection for stored butter. Whilst infected parchment is less important than infected timber as a source of mould, it is readily pierced by mycelium and consequently affords inadequate protection to butter from an infected container.

Butter that has been held in cold storage is very susceptible to infection from timber during the defrosting process. This is demonstrated by the facts that butter-boxes heavily infected with mould spores showed no growth of mould prior to and on immediate removal

from storage, whilst they developed profuse growth during defrosting. Thus trouble with mould in export butter is not likely to be observed till the butter has reached the retailer.

Because of the widespread occurrence of mould spores and the ease with which they are carried by wind, it is impossible to avoid spores on butter-box timber. Under normal defrosting conditions no trouble is experienced from a normal spore load. Yet excessive infection may cause trouble in any circumstances and, what is even more important, there are conditions under which mould-growth from normal spore

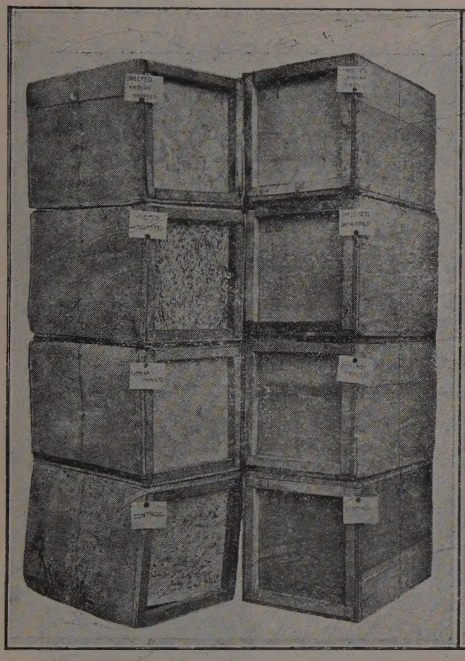

FIG. 4.

Left stack, rotary-cut 1¼ in. Saranac; right stack, sawn ⅜ in. Saranac. Top tier: Infected, treated. Second tier: Infected, untreated. Third tier: Not infected, treated. Bottom tier: Not infected, untreated. *[Photo by H. J. Drake.*

FIG. 5.

Left stack, standard Swedish pine; right stack, sub-standard Swedish pine. Top tier: Infected, treated. Second tier: Infected, untreated. Third tier: Not infected, treated. Bottom tier: Not infected, untreated. *[Photo by H. J. Drake.*

load may be favoured. These conditions are (*a*) the deposition of free moisture on the inner surface of butter-boxes and on the lining parchment-paper; (*b*) the admission of air to the space between the butter-box and the parchment; and (*c*) the presence of readily available nutrient substances in certain types of timber.

The transference of butter from cold stores to chambers held at atmospheric temperatures naturally leads to the deposition of moisture on the boxes. This deposition is accentuated by high temperature, high humidity, close stacking, and lack of air circulation. Obviously

most trouble is likely to be experienced in summer months. Ideally, cold-stored butter should be defrosted in chambers that can be air-conditioned, but this is impracticable under commercial conditions, and, in any case, present losses do not warrant these precautions in temperate climates.

It is quite clear that the thickness of timber exercises a distinct influence, $\frac{1}{2}$ in. white-pine timber developing less mould-growth than $\frac{1}{4}$ in. That this is not likely to be due to differences in the insulating property of the different thicknesses of timber has been shown by McDowall(5). The more likely explanation is the capacity of the thicker timber to absorb more moisture without becoming soaked. On

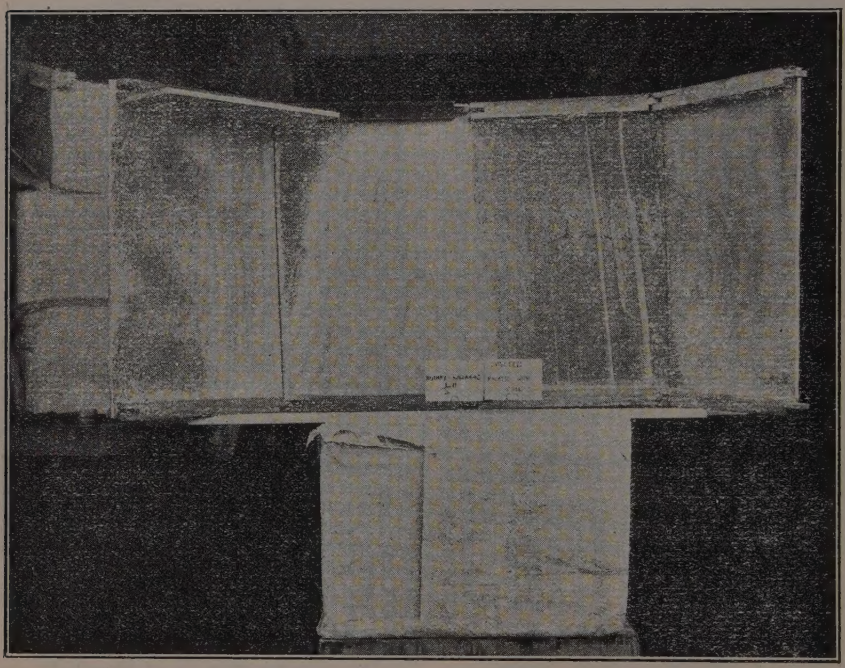

FIG. 6. ROTARY-CUT SARANAC, INFECTED, RESTING ON CONTAINED BUTTER PACKED WITH ALUMINIUM-FOIL PARCHMENT.

[Photo by H. J. Drake.

removal from a cold store the moisture content of butter-box timber is lower than when admitted to the store. This is illustrated by the fact that the wires on waxed boxes never became so loose as those on unwaxed. During the defrosting process the wood thus absorbs some of the dew as it is formed, and if it can do so at a rate commensurate with that at which the surplus collects there is not likely to be sufficient for mould spores to germinate. The thicker the timber the less free moisture may be expected to accumulate. This may therefore be the explanation of the benefit of using $\frac{1}{2}$ in. or $\frac{3}{8}$ in. instead of $\frac{1}{4}$ in. timber.

The admission of air apparently plays an even more important part. It is a significant fact that in these experiments mould-growth was

extremely profuse on the internal surface of boxes to which air was admitted through openings caused by staples springing from the junction of the sides and ends of the wire-bound boxes. This is probably due to heavy condensation of moisture on the cold surface of the parchment, where, being sheltered from air currents, it is not quickly evaporated. Thus absence of external mould is no guarantee of freedom from internal infection. This emphasizes the great need for so constructing boxes, by using additional staples, clinching their ends, or employing dovetailed pieces of timber, that the sides and ends will remain intact, even when submitted to rough handling.

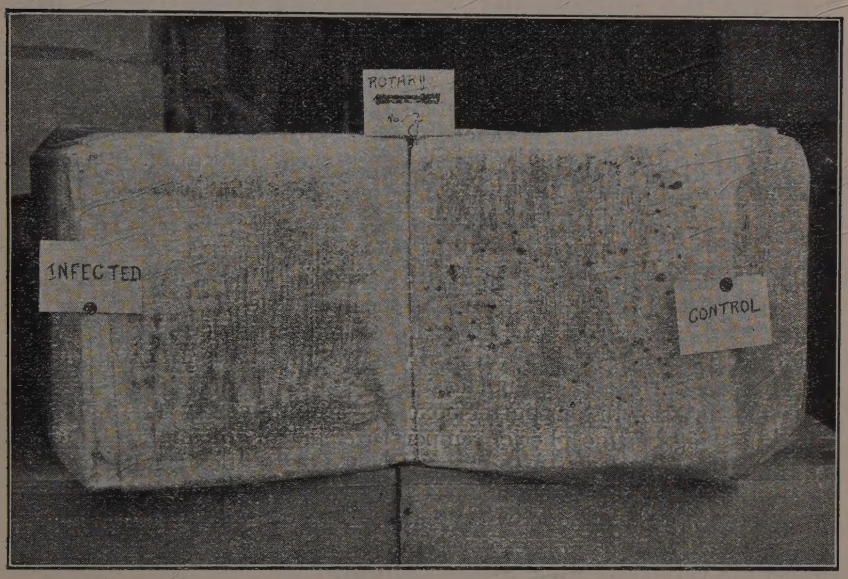

FIG. 7. SURFACE MOULD ON PARCHMENT.

Note the spreading growth from the artificially-infected box and the localized growth from the normal.

[Photo by H. J. Drake.

The type of timber also plays an important part. White-pine timber in the experiments under review developed much more mould than Swedish pine. Whether this is due to a natural fungicide in Swedish pine or to the higher sugar content of white-pine was not investigated.

More important, however, than the observation on differences due to species of timber is that "heart"—close grained—white-pine timber scarcely supports mould-growth at all, while the softer sap-wood provides a splendid medium for mould. This is very clearly observed when a side is made of two pieces, one of hard wood, the other of soft (Fig. 6). The use of soft wood must therefore be avoided when dressing timber for butter-boxes. It is also important to observe that rotary-cut timber is much more sensitive to mould-growth than sawn timber.

The results obtained from the treatment of timber with an aqueous solution of the harmless fungicide sodium salicylanilide are most

encouraging. It would not be unreasonable to presume that the 0·1 per cent. solution with 10 minutes' immersion used in this experiment would give absolute satisfaction under commercial defrosting conditions, because the two boxes that were not entirely free of mould after treatment were only slightly affected and the experimental conditions were such as to encourage the maximum possible mould-growth. Further experimentation is required to determine the minimum strength of solution and period of dip necessary to prevent mould-growth. (Thereafter the extent to which it can be used depends upon treatment costs.)

The results obtained with the use of aluminium-foil parchment show that this wrapping has yet another advantage besides those which have already been described(4).

The results obtained with the $\frac{3}{8}$ in. sawn Saranac container raise the possibility of using this as a standard export type. It combines the advantages of the $\frac{3}{8}$ in. timber of the sub-standard with the structural advantages of the Saranac type and, provided that the sides are adequately attached to the ends, it gives every indication of being a reliable and attractive container.

Summary.

(1) Moulds originating in butter-boxes may infect the surface layer of butter packed therein and cause extensive damage.

(2) A double layer of 28/30 lb. parchment does not prevent mould mycelium from penetrating from the internal surface of butter-boxes to the surface of the butter.

(3) Mould-growth on butter-boxes is stimulated by (*a*) defrosting butter at high atmospheric temperature in air of high humidity; (*b*) the admission of air to the inner surface of the box; (*c*) the use of sap timber in place of heart timber; and (*d*) the treatment of timber by processes which render it more susceptible to mould-growth.

(4) Quarter-inch butter-boxes made from rotary-cut white-pine timber are very susceptible to mould-growth.

(5) Standard, $\frac{3}{8}$ in. sawn Saranac, sub-standard, and $\frac{1}{4}$ in. sawn Saranac boxes made of white-pine do not readily develop mould-growth, but they are increasingly susceptible to infection in the order named.

(6) The "springing" of the sides from the end of Saranac boxes and the admission of air along the sides readily stimulates mould-growth on the internal sides of the boxes.

(7) Swedish-pine timber, impregnated with wax, is less susceptible to mould-growth than white-pine, but imparts an undesirable timber taint to the surface of the butter.

(8) Immersion of butter-box timber in an aqueous solution of sodium salicylanilide promises to be an effective method of preventing mould-growth in butter-boxes.

(9) Aluminium-foil parchment prevents mould from penetrating from infected boxes to the surface of butter packed therein.

Acknowledgments.

Dr. F. H. McDowall, of the Institute staff, examined the surface of the butter for the presence of Shirlan W. S. Three vendors of butter-boxes made available the various types of boxes used in the experiments,

and the National Dairy Association provided, free of cost, the aluminium-foil parchment. Mr. H. Drake photographed the boxes, and Mr. J. W. Smith, Dairy Factory Superintendent, supervised the packing, defrosting, and examination of the butter.

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COMMERCIALIZATION OF HYBRID-VIGOUR IN THE TOMATO.

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Hybrid-vigour.

Fertilization in plants is effected by the union of germinal material present in the pollen (male) and the ovules (female) resulting in a new individual which derives its germinal constitution from its parents. The germinal material carries genes which are transmitted to the progeny, and it is the expression of these genes in the progeny that determine its appearance and behaviour.

Certain of the genes are responsible for the expression of such characteristics of the plant as maturity, vigour, fruit-production, and disease resistance. The more desirable reactions of these characteristics are generally partly or wholly dominant over their alternatives, and therefore if brought in by means of crossing they become manifest in the first generation.

It is unlikely that any single variety will carry a full complement of the large number of genes responsible for the expression of these desirable characteristics, but any one variety will carry certain of them, and the genes that are not carried by it may be carried by some other varieties. This opens up the possibility of combining in one individual the desirable characteristics of the two varieties, thereby increasing the productivity of the hybrid beyond that of either parent. Success depends, of course, on the possibility of finding two varieties which are of mutual help in this respect, each bringing in its quota to be combined in the hybrid. This expression of vigour is termed hybrid-vigour, or heterosis.

Varieties which are alike in appearance may have much the same origin, and therefore carry much the same range of vigour factors. In such cases the hybrid may show little or no increased vigour. On the other hand, varieties dissimilar in appearance are likely to be of dissimilar origin, and when crossed give a greater measure of hybrid-vigour. This generally proves to be the case.

The possibility of capitalizing hybrid-vigour depends upon its extent and the cost of producing hybrid seed. It is likely to be most attractive commercially when a little labour results in the production of a large amount of seed. The tomato is an example in which one cross will furnish a large amount of seed, and it is found that the measure of improvement resulting from certain crosses more than compensates for the cost involved in producing the hydrid seed. Generally speaking, the hybrid is earlier, produces a heavier yield, and the fruit is intermediate in appearance between the two parents.

Plants like wheat and peas that are self-fertilized become "fixed," and the progenies of a single plant resemble the parent. The tomato is dominantly self-fertilized and therefore, generally speaking, its characteristics are "fixed." In this event the first-generation hybrids are all alike, although differing in some respects from either parent. This uniformity is not permanent, for in the second and subsequent generations segregation occurs and many variations arise. It is from this segregating material that the plant breeder makes his selections and later attempts to "fix" them. Naturally the same position arises in the case of the hybrid-vigour. Its expression is at its maximum in the first generation following the cross, and is not permanent because in subsequent generations segregation occurs and hybrid-vigour becomes less progressively with each generation.

The problem then resolves itself into finding varieties which when crossed result in some definite improvement above either parent along the lines of increased yield, earlier maturity, or improved quality.

Several workers have investigated the possibilities of commercializing hybrid-vigour in tomato-production. In general, hybrid-vigour has been demonstrated, and in certain cases this has been reflected in an increased yield of fruit and in precocity. Alabouvette and Titard (France) found the greatest increase in two varieties with the least morphological resemblance.

New Zealand Trials.

The trials to be discussed were conducted at the Plant Research Station, Palmerston North. Four varieties, selected at random, were used—namely, Large Red, Early Cluster, Kondine, and Sunrise. Kondine and Sunrise proved to be very similar in nearly all respects, and Early Cluster was not markedly different from these. Large Red, however, proved quite distinct in maturity, growth, yield, and shape of fruit. It was unfortunate for the purposes of this trial that three of the varieties were so similar to one another.

The varieties were crossed one with another, both ways, in 1933–34, and the resulting hybrid seed was sown in 1934–35. The seedlings were planted out, staked, and pruned to a single stem, in a manner similar to that adopted generally by commercial growers. Each plot consisted of five plants, the hybrid plot being grown alongside the parent plots for purposes of comparison, and the whole trial replicated three times. The fruit was picked and weighed when it showed colour, and usually two pickings each week were found necessary. This allowed determination of not only the total yield but also the earliness of maturity (precocity).

General Observations on Results.

It was observed throughout that the hybrid plants grew more vigorously than the parents, but no measure of this was attempted. The

hybrid fruit was, in appearance, intermediate between the parents, although this observation was possible only in the crosses with Large Red, which was sufficiently distinct from the other varieties (Fig. 1). In certain cases the hybrid plants gave a greater yield than either parent, and in nearly all instances were noticeably earlier.

As yield and maturity are the two most important factors, these will be considered in respect to each cross. There were fourteen weighings taken altogether, and the presentation of such a mass of detail would be confusing. The yields are therefore presented at three periods and as a total.

The first period is between 9th January, 1935, and 28th January, 1935. During this month tomatoes were scarce, and retailed as high as 8d. per pound; therefore any increase in yield at this time was worth nearly double any in the succeeding period. The second period extends from 29th January, 1935, to 4th March, 1935, when tomatoes averaged a retail value of about 4d. per pound. During the final period, 5th March, 1935, to 22nd March, 1935, tomatoes could be purchased at as low as 2d. per pound, and at the final picking on 22nd March, 1935, all fruit, whether ripe or not, was picked owing to the danger of frost.

It is necessary therefore to bear in mind the importance of early maturity in assessing the value attending the use of hybrid seed. The yields given are those from three plots each of five plants, and in all cases the mother plant that was used in the cross is mentioned first and the pollen-bearing plant second.

TABLE 1.—LARGE RED CROSSED WITH KONDINE.

	Yield of Fruit, in Pounds.			
	9th January, 1935, to 28th January, 1935.	29th January, 1935, to 4th March, 1935.	5th March, 1935, to 22nd March, 1935.	Total.
Kondine	11·6	80·8	31·4	123·8
Large Red	30·7	53·9	16·0	100·6
Kondine × Large Red	26·0	87·4	32·3	145·7
Large Red × Kondine	32·8	74·8	23·7	131·3

Kondine is the heavier-yielding parent and Large Red the earlier. Both crosses yielded more heavily than the heavy-yielding parent, and in maturity proved to be about equal to the early-maturing parent.

There has therefore been a distinct improvement, because it has been possible to increase yield and at the same time to maintain early maturity.

TABLE 2.—LARGE RED CROSSED WITH EARLY CLUSTER.

	Yield of Fruit, in Pounds.			
	9th January, 1935, to 28th January, 1935.	29th January, 1935, to 4th March, 1935.	5th March, 1935, to 22nd March, 1935.	Total.
Early Cluster	16·4	89·0	41·1	146·5
Large Red	30·7	53·9	16·0	100·6
Early Cluster × Large Red	26·2	92·2	31·7	150·1
Large Red × Early Cluster	25·4	77·0	29·4	131·8

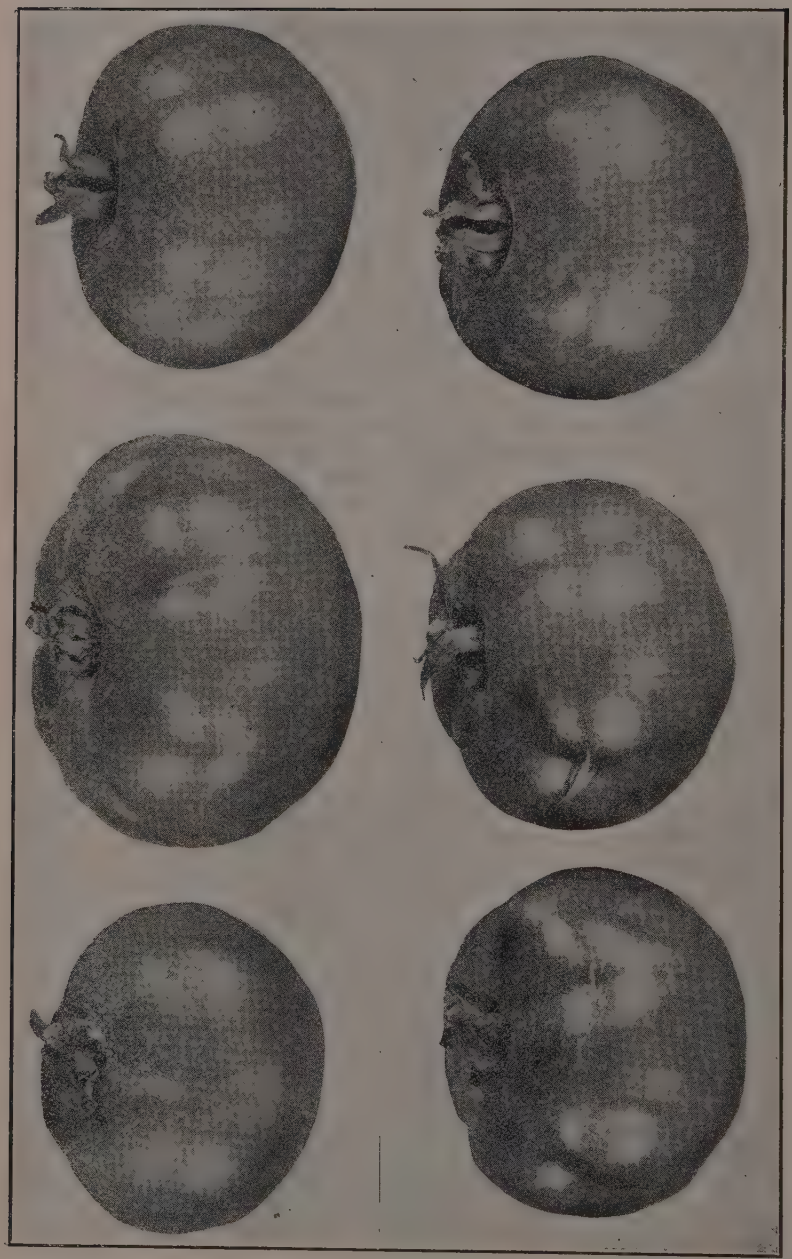

FIG. 1.

Top: Left, Early Cluster; centre, Large Red; right, Kondine. Bottom: Left, Early Cluster crossed with Large Red; centre, Kondine crossed with Large Red; right, Kondine crossed with Early Cluster.

Of the parents in this cross Early Cluster outyields Large Red, but the latter is decidedly earlier in maturity. In Early Cluster × Large Red the yield is about the same as the heavy-yielding mother plant (Early Cluster), but is markedly earlier and approaching the maturity of Large Red. In the reciprocal cross Large Red × Early Cluster the yield is definitely above the maternal parent, but precocity not quite so marked.

It may be said of this hybrid that it approximates the yield of the heavier-yielding parent and approaches the maturity of the early-maturing parent. It does then to a large extent combine the good qualities of both parents.

TABLE 3.—EARLY CLUSTER CROSSED WITH KONDINE.

	Yield of Fruit, in Pounds.			
	9th January, 1935, to 28th January, 1935.	29th January, 1935, to 4th March, 1935.	5th March, 1935, to 22nd March, 1935.	Total.
Early Cluster	13·5	98·5	43·6	155·6
Kondine	14·2	98·6	34·0	146·8
Early Cluster × Kondine	19·2	106·4	36·9	162·5
Kondine × Early Cluster	32·4	97·8	37·5	167·7

The parental varieties of this cross are seen to be somewhat alike in yield and maturity. Both crosses have given a small and probably non-significant increase over both parents, but the most striking difference is to be seen in maturity. The hybrid is definitely earlier than either parent.

The general similarity of the parents would not lead to the expectation of any marked increase in yield.

TABLE 4.—KONDINE CROSSED WITH SUNRISE.

	Yield of Fruit, in Pounds.			
	9th January, 1935, to 28th January, 1935.	29th January, 1935, to 4th March, 1935.	5th March, 1935, to 22nd March, 1935.	Total.
Kondine	14·2	98·6	34·0	146·8
Sunrise	12·9	98·7	29·4	141·0
Kondine × Sunrise	26·3	84·0	37·8	148·1
Sunrise × Kondine	25·4	86·7	37·7	149·8

It has already been pointed out that these varieties appeared almost identical, and the hybrids have given a very small, non-significant increase over the parents. In earliness of maturity the hybrids are, however, definitely superior to both parents.

Of other crosses made, Large Red × Sunrise was intermediate in yield between the parents, and in maturity was definitely earlier than Sunrise. The reciprocal cross was unfortunately lost, and comparisons cannot be made.

In the trial of Early Cluster × Sunrise, the latter variety proved to be both earlier and heavier-yielding than Early Cluster, and the

hybrid almost attained the heavy yield of Sunrise, and surpassed it in earliness of maturity. The reciprocal cross was in this instance also lost.

Summary of Results.

(1) The use of first-generation hybrid seed of tomato does in the case of certain crosses result in a yield higher than either parent; failing this the trend is towards the higher-yielding parent.

(2) The use of such seed does in the case of certain crosses hasten maturity beyond either parent or, failing this, the maturity has a decided trend towards the earlier-maturing parent.

(3) Taking into consideration the combination of increased yield and earlier maturity, it would appear that sufficient improvement may be expected to warrant the cost of producing hybrid seed for commercial purposes.

(4) There is evidence that crosses between dissimilar varieties are likely to result in a greater measure of benefit than are those made between varieties of great similarity.

(5) These trials were designed to explore the possibilities of the utilization of hybrid-vigour. This being sufficiently proved, the next step must be to discover those varieties which, when combined, result in the greatest measure of benefit.

Technique of Tomato Hybridization.

The tomato is normally a self-fertilized plant. The pistil, or female organ, is a thin green projection arising from the ovary; it terminates in the stigma, which, when receptive, exudes a sticky secretion. This structure is enclosed within five anthers, or male organs, set on very short, stout stems or filaments. These anthers are joined laterally and are arranged in a cone-shaped formation with an opening at the apex. They are two-lobed and, when ripe, split along the line of dehiscence occurring on the inner side of each lobe. Thus the pollen is exerted inwardly, whence it comes in contact with its own stigma (Fig. 2).

It is essential for crossing purposes to know the stage in the development of the flower at which this pollen distribution occurs, for emasculation or removal of the anthers of the female parent must take place prior to this period. By a careful examination of a few flowers, the approximate stage at which pollen is freed can be recognized. It is generally when the flowers are about half-bloom; subsequent to this self-pollination will occur (Fig. 3).

When a flower suitable for crossing has been selected, most of the others on the same cluster should be removed; this allows for more favourable development. Emasculation may be effected quite easily with a pair of tweezers, though care must be taken not to burst the anther or to damage the pistil. If carried out at the half-bloom stage, the stigma is generally in a condition for immediate pollination, but, when effected earlier, which is preferable, a day or two should elapse before foreign pollen is applied; in this case it is advisable to cover the exposed stigma with a paper cover until ready for pollination.

The application of pollen is quite a simple operation. As it is advisable that the pollen for crossing should be as fresh as possible, flowers between the half-bloom and the full-bloom stage should be utilized. If the anthers are divided, an examination of their inner

surfaces will reveal whether or not the line of dehiscence has begun to split and thus whether or not the pollen has been exerted. The most satisfactory supply of pollen is available at the commencement of the splitting process. It may be applied by brushing the stigma

FIG. 2. PARTS OF THE FLOWER OF THE TOMATO.

A. Arrangement of stamens around pistil. Petals and sepals removed.
B. Appearance of pistil and stigma. Stamens, petals, and sepals removed.
C. Inner surface of the anthers at about the stage for pollinating purposes.

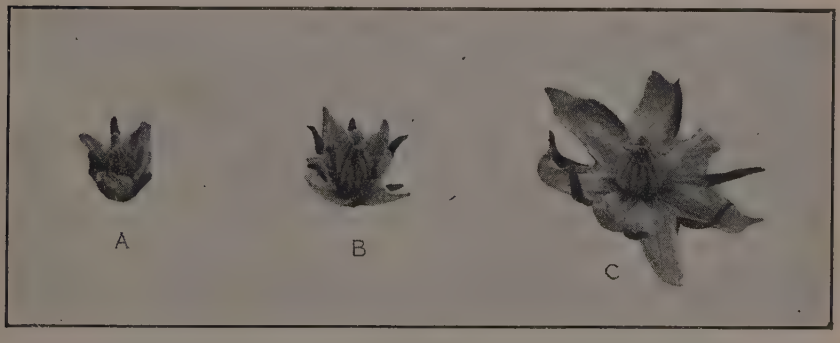

FIG. 3. STAGES IN THE DEVELOPMENT OF THE TOMATO FLOWER.

A. If emasculated at this stage a period of from two to three days must elapse before pollination.

B. At this stage pollination may be effected immediately after emasculation.

C. Full-flower stage. The pollen-sacks have probably burst and the stigma already pollinated. It is therefore too late for crossing.

of the prepared female individual with the inner surface of the anthers; if the stigma is receptive—and this can generally be determined by its appearance—the pollen adheres and fertilization takes place. For genetical investigation it is advisable to cover the effected cross with a waterproof paper cover, but for commercial purposes this is not necessary.

If a number of different crosses are being made consecutively, it is essential to wash the hands and any instruments with alcohol after each separate cross; this renders ineffective any adhering pollen.

Saving Seed.

The fruit should be picked when ripe and placed on one side till it is slightly over-ripe. It should then be pulped in a jar and allowed to ferment for about five days to liberate the seed from its surrounding tissues. When fermented a large quantity of water is added, and, after being well stirred, the pulp and flesh is skimmed off the top. If fermentation has been thorough the seed sinks to the bottom, and, by repeatedly adding water and decanting it, clean seed is obtained. The seed should be spread out to dry on some absorbent material. The seed should be dried thoroughly before it is stored away. The seed remains viable for several years, and hybrid seed need not be produced more frequently than every other year.

In determining the number of crosses to make it may be assumed that an average tomato gives two hundred seeds. To check this seventeen medium to small fruits were pulped. These yielded 3,300, or 194 seeds per fruit. Germination of good tomato-seed is generally about 99 per cent.

VALUE OF STRAINS OF RYE-GRASS IN CANTERBURY.

J. W. Calder, Canterbury Agricultural College, Lincoln.

Canterbury is recognized as one of the main cropping-areas in the Dominion, and the climate and soil conditions are particularly suited for this type of farming. Nevertheless, the greater part of the land is in pasture. Of the 2,750,000 acres of cultivated land, 1,750,000 acres are in grass over two years old, and about 250,000 acres are sown down in new grass each year. Cereals and pulse crops occupy about 500,000 acres and fodder crops about 250,000 acres. The 750,000 acres of crops are sown in rotation with pastures which remain down from two to ten years or so, and the young grass is sown at the end of a cropping programme. Owing to climatic conditions, these pastures fail to provide the necessary feed at two periods—namely, in winter and early spring as a result of low temperatures, and in summer and early autumn as a result of drought. It is necessary, then, to provide the supplementary feeds for these two periods. Turnips, hay, chaff, green-feed oats, and Italian rye-grass for the winter and early spring, and green-feed rape, soft turnips, &c., for summer and autumn periods. These supplementary feeds are essential, but they are costly to grow, so that any feed which can be secured from pastures at these times will

lower the cost of producing supplementary feeds, and will be more valuable than a heavier production during the periods when feed is plentiful.

Variations in the type of farming in Canterbury on the different classes of land and on different farms on the same class of land are frequent. One farmer might run a grazing-farm, another a cropping-farm, but the majority are engaged in mixed farming and can increase or reduce the grassing or cropping as the market conditions indicate. This is shown by the correlation between the number of sheep and the area in grass. For example, let us compare the two seasons 1932–33 and 1933–34. In the latter season there were 450,000 more sheep in Canterbury than in the former season. This increase was associated with an increase in grass area as follows: Old pasture, 56,000 acres; new grass, 49,000 acres, while 28,000 acres less seed (grass and clover) and 15,000 acres less hay were cut. In addition to the extra feed from pastures, there was an additional 14,000 acres of fodder crops. Cropping was reduced by 50,000 acres. This means that many of our pastures in the cropping district must be capable of remaining for several years in a productive condition when profits from lamb and wool are greater than the profits from cereal-growing—*i.e.*, the dominant species shown in a mixture should be permanent ones. When a period of profitable cereal-cropping arrives the farmer will then be in the position of having to make a decision as to which of his pastures he will plough up rather than in the position of having to plough up a field because there is no grass on it. And it needs little imagination to visualize the better crops which will be obtained when a good turf which has been well stocked be ploughed under than when a bare open caked surface be turned over. One is well aware that other factors, such as management, manuring, and climatic conditions, will all have their effect in making a good pasture, but, unless the foundation of perennial plants is there, a satisfactory long-lived pasture cannot be secured.

Perennial rye-grass can occupy the dominant position in most permanent pastures on the medium and better soils where it persists and its production is influenced by rainfall and management. It shoots to seed readily on the approach of dry weather and remains in a dormant state until conditions again favour growth. On the light plains it does not satisfy the requirements of a permanent pasture after the relative high fertility associated with fodder crops and cultivation has reached normal in two or three years. The rapidity with which these soils dry out and their low moisture-holding capacity make conditions too severe for permanent productive rye-grass pastures. For long term pastures on this class of land cocksfoot should form the dominant constituent in the mixture.

Strains in New Zealand Rye-grasses.

Some years ago it was the general experience that perennial rye-grass would not hold for more than a year or two on many areas in Canterbury. Dr. Hilgendorf, when he commenced work on grasses, drew attention to the fact that, in Canterbury, it was not so much perennial rye-grass that was at fault, but the strain of rye-grass used. He grew plots of the ordinary commercial rye-grass alongside plots of rye-grass harvested from a field which had been in grass from forty-five to fifty years, and at the end of two years about

90 per cent. of the plants from commercial seed and 5 per cent. or 6 per cent. of the plants from the old pasture had died. Mr. Levy, at Palmerston North, grew a comprehensive series of commercial lines of rye-grass from throughout New Zealand, and he showed that the only lines of true perennial which were being harvested and sold on the market came from old pastures in non-cropping areas, chiefly from Hawke's Bay, with the result that these lines now occupy the predominating position in the Department's certification scheme, which was started as the result of these trials.

Origin of Strains.

What is the origin of these temporary strains? Among the crops that are frequently grown in Canterbury is Italian rye-grass. Sown in summer or early autumn, it provides valuable autumn, winter, and spring green-feed for ewes and lambs when pastures are dormant. After the flush of other feed arrives it is shut up for seed. From 10,000 acres to 15,000 acres of Italian rye-grass are so used each year. This, in itself, would probably not have been detrimental to the perennial strain of rye-grass, but, in addition to its use as a fodder crop, a small amount of Italian was often included in the rotation pasture-mixture with the object of providing the valuable winter and early-spring grazing. These pasture-mixtures were predominantly perennial rye-grass, and, when conditions warranted, they were shut up for seed. The seed crop, especially in the first year, would contain a percentage of Italian rye-grass in it. If this mixture were only a mechanical one, and was purchased with this knowledge, no harm would result, but experimental work has shown that the two species, Italian and perennial rye-grass, are readily cross-pollinated, with the result that, in addition to a mechanical mixture, we get a biological mixture. Frequently this complex mixture was sold as perennial, and was included in a pasture-mixture together with a bit more Italian, and so the process went on for some generations, until many of the lines were predominantly Italian or Italian hybrids. They were temporary in nature, and contained a small percentage of perennial plants according to the number of generations that they were exposed to Italian contamination.

The Value of Strain in Rye-grass.

In the first place, true perennial rye-grass is long-lived under a wide range of soil and management conditions, and should form the basis of mixtures for the rotation pastures of from two to ten years or so on medium to better class soils. The temporary strain thins out after the first year or two, and low-production grasses, such as brown-top, sweet vernal, fog, or Danthonia, establish on the bare spaces and soon gain possession. The widespread occurrence of these and other pasture weeds on many areas of cultivated land is mute testimony of the temporary nature of the sown species. The temporary strains, owing to their Italian "blood," produce earlier and more palatable grazing, and this superiority may last for a few months, but, after the first autumn, a high percentage of the plants die, so the strain is not at all suited for the long-term pastures. For one or two years' grazing on all soil types supplying the autumn, winter, and spring periods the Italian and red-clover mixture is supreme. The occupation of the sward by the

true perennial rye-grass under good management gives a higher carrying-capacity than a sward dominated by the low-producing but long-lived brown-top and Danthonia, and this in turn means higher fertility when the pasture is broken up for a period of cropping. The treatment which perennial rye-grass gets is responsible for its behaviour, and many pastures are ruined by overgrazing at critical periods. This applies particularly to the pastures of the light, shingly plains. During dry periods the perennial rye-grass dries up or shoots to seed, and unless there are supplementary feeds available the pastures are of necessity heavily punished by overgrazing. This period of overgrazing during drought weakens the plants, and those that do not die are unable to grow vigorously when conditions do favour growth.

Palatability.

The question of palatability has been prominent in reference to the perennial rye-grass. There is no question that it is less palatable than Italian or than the "mixture" with which it has so often been compared to its disadvantage. When badly managed, the unpalatable nature can be so emphasized that sheep will not eat it, and go back in condition. Under good management, however, it forms the basis of a palatable pasture on which sheep thrive. Most of the criticism against perennial rye-grass has fallen on those pastures which were sown with pure rye-grass for seed purposes, those which had become rank before grazing, or those which had been cut for seed, the dry aftermath being grazed. Another condition which accentuated the unpalatable nature was the practice in cropping-farms of sowing the grass in the autumn after one or two cereal crops. Under these conditions the fertility is relatively low, the soil is dry and the tilth is poor, with the result that autumn growth of grass is slow and the plants are fibrous and lack vigour. This pasture will remain poor and unpalatable for two or three years, while one sown on a fertile and well-prepared seed-bed will be of high production right from the start. Palatability is important, for, after all, the feed is grown for the stock, and they eat less of an unpalatable food and consequently do not thrive. Therefore, every effort should be made to keep the grass as palatable as possible by sowing suitable mixtures, by grazing it when reasonably short, and by sowing under high-fertility conditions.

Competition in a Mixture.

There is another factor which must be taken into consideration, and that is the effect of competition of perennial rye-grass on its associate plants in the mixture. Perennial rye-grass is an aggressive plant not only in the first year, when it is severe, but also in succeeding years to a less extent. This aggression is the result of its relative rapid growth on a cultivated seed-bed, its strong growth under stocking, and the thickness of seeding which is usually applied. It thus competes with other plants in the mixture—cocksfoot, red clover, and white clover—which are slower to establish. The effects of this competition are not so marked when the mixture has been sown in November, December, or January, because the more slowly established plants, though checked, are

not killed, and, after some autumn grazing and dry weather has checked the rye-grass, they are enabled to become sufficiently well established to survive the winter, and later contribute to the feed-supply. When, however, the mixture is sown in late February, March, or April, as is commonly done in cropping-areas, the checking of the cocksfoot and clovers is responsible for their slow development, and the clovers are hardly out of the three-leaf stage and the cocksfoots are only small plants when the frosts come. In this stage they are subject to frost-lift, more especially when the ground is wet. In order to make conditions as favourable as possible for the other plants sown in the mixture with perennial rye-grass, early sowing should be practised and the young pastures should be judiciously grazed to prevent a smothering growth of rye-grass.

Conclusion.

The true perennial rye-grass strain is a long-lived perennial, and should form the basis of all long-term pasture-mixtures on all but the lightest and driest soil types, while the temporary type, which is not perennial rye-grass at all but a hybrid mixture, is short-lived, and should be omitted from all long-term pastures. There is a difference in palatability between the two, but the lower palatability of the true perennial can be minimized by sowing well-proportioned mixtures, by encouraging rapid growth, and by keeping the grass grazed to prevent its becoming tough or fibrous. The severe competition exerted by perennial rye-grass is responsible for a deficiency of associate plants in a pasture, but this can be minimized by early sowing and by grazing to prevent the rye-grass developing a smothering growth.

FACTORS LEADING TO EXCESSIVE WASTAGE IN THE PIG INDUSTRY.

D. Marshall, Veterinarian, Hamilton.

Consideration of slaughtering and inspection figures over the past season emphasizes the loss through condemnation of pig-carcasses or their rejection for export, which represents a serious loss to the farmers and to the country. It is, however, only a portion of the wastage in the industry.

Mortality at Birth.

Mr. H. M. Peirson, Recording Officer of the Waikato Pig Recording and Research Association, in his annual report states that " A mortality of 22 per cent. had to be recorded between birth and weaning. The greatest percentage of deaths has been recorded as ' born dead,' which is not actually the case. Had some one been in attendance at the time of farrowing, the death-rate would have been reduced very considerably, as in many cases the pigs born (alive) died of suffocation." This is in recorded herds where the Recording Officer is advocating the value of management, and attention at farrowing, and where owners take more than average interest in their pigs. The loss at this period may well be greater over all herds.

Some of the farm loss through pigs being born prematurely, or imperfectly developed, or dead, is undoubtedly due to defective feeding of the pregnant sow. Successful breeders have shown that the supposed danger of sows being "too fat at farrowing" does not arise if the sow is active and healthy. As in the case of other stock, pigs provide evidence that better feeding of the pregnant mother results in heavier young being born. On the other hand, pregnant sows underfed, either through lack of green feed in dry autumn periods, or poor-quality herbage and no supplement, such as meat-meal and roots or milk, during the winter, are more liable to the above losses.

Loss after Weaning.

Further wastage occurs between eight and twelve weeks. This appears to be one of the most susceptible periods of the pig's life. It follows directly on weaning, and unless the creep system or other method has been developed to make the change from mother's milk less of a shock, and unless care and conditions at this stage are good, the pig suffers from the change in diet, it has frequently to contend with older pigs at feeding, and is exposed to the hazards of overcrowding and dirt. Even if the pig survives this period, under bad conditions it may contract some infection which, while not fatal, renders its carcass at a later stage unexportable or even unfit for consumption.

Fawcett, in a statistical survey of the position for 1934, estimated by a comparison of the number of pigs that should have been available for slaughter with those actually put through that there was a discrepancy of 125,000, or, in other words, a death-rate of 125,000 pigs.

Bacillus suipestifer infection is an important bacterial factor in the mortality at the eight to twelve weeks' period and will be dealt with later.

Causes of Condemnation and Rejection.

The following are the chief causes of condemnation and rejection: tuberculosis, pleurisy, peritonitis, septic wounds, faulty castration, arthritis, nephritis, bruises, and skin-lesions. It should be emphasized that, with the possible exception of tuberculosis, all are the results of defective management and are to that extent preventable.

McIlwaine, in this *Journal*, October, 1935, writes, "There is no doubt whatever that if greater attention is paid to the cardinal matters—improved housing, feeding, and improved conditions—the alarming mortality in young pigs would be reduced to reasonable proportions." To quote again H. M. Peirson, "The more pig-recording is extended the more definite has it become that management is the biggest factor in successful pig-keeping . . . It is still unsatisfactory to find that the pig is the first animal to be neglected on the farm. At haymaking and holiday-time the weights of many litters shows a considerable decline." What are the reasons for this? One might suggest failure to recognize the extent of loss and the value of housing and hygiene, overwork, and lack of sufficient time to attend to pigs, or a method of pig-farming not suited to the soil type and locality. Success in pig-farming is usually under one of the following conditions: Locality highly suitable with dry subsoil, sunny aspect and abundant natural shelter, plant big enough to employ one or more men the whole time, or else the owner or one of his staff keenly interested in pigs and able to take the time necessary to attend to them.

Tuberculosis.

The most common source of tuberculosis is undoubtedly infected skim-milk. Other ways of infection are grazing after infective cows, association with other pigs in an advanced stage of the disease, or with tuberculous poultry, or possibly from a diseased mother. Bad housing, sanitation, and management cannot themselves cause the disease, but may be responsible for its spread and for its more rapid development in any pig once infected.

Visible signs of the presence of tuberculosis in the pig are not common. Detection of every possibly infectious cow in the herd is not easy without the use of the tuberculin test. Infections from this source could be lessened, however, were farmers to familiarize themselves with the suspicious signs, and to promptly report to their Inspector of Stock any cows showing these. They are—

(1) Tuberculosis of the lungs: Loss of condition and chronic cough, the cough being manifested after exertion.
(2) Tuberculosis of the throat-glands with peculiar carriage of head, abnormal "roar" in breathing, or swelling at throat.
(3) Swelling of any superficial lymphatic gland, the three chief being below ear, front of shoulder, and fold of flank.
(4) Tuberculous mammitis: Gradual increase in size and hardness of one quarter of the udder without previous acute inflammatory stage of ordinary mammitis.

Pleurisy.

Pleurisy is inflammation of the normally smooth and thin membrane lining the inside of the chest and also covering the lungs. The condition found in slaughtered animals is usually a thickening of the membrane as a result of a previous acute attack of pleurisy. If thickened, the membrane must be stripped off, and the British authorities will not accept carcasses from which the pleura has been removed. Cases condemned are those in which the inflammation is still in the acute and fevered stage or septic fluid is present in the chest.

Practically all cases of pleurisy are associated with some degree of pneumonia, the symptoms of which we recognize in the piggery. Numerous specimens of lung from pigs found with pleurisy in slaughterhouses have been examined at the Veterinary Laboratory at Wallaceville, and in a large percentage *Pasteurella* organisms, believed to cause swine plague or infectious pneumonia, have been found.

Pasteurellosis, therefore, becomes of importance not only on account of the mortality it causes, but also because of ill effects (in the form of a thickened pleural membrane) left behind in recovered cases. According to one authority, the infection is more widely spread than the disease, suggesting that certain pigs may carry the infection without suffering.

Factors lowering vitality and rendering pigs susceptible thus become of importance, and these are poor housing, lack of shelter to runs, dirt, and overcrowding. Pasteurellosis may be introduced into a piggery by purchased pigs, hence the importance of isolating these for ten days.

Symptoms are cough, discharge from nose, watering of eyes, together with hurried jerky breathing. Condition may be lost, and deaths

occur; occasionally pigs over a fairly wide age-range and up to the heavy porker are affected. The trouble should be treated by isolating affected pigs, feeding light laxative diet including molasses and cod-liver oil, teaspoonful daily, in milk. It is advisable to spray houses and bedding with creasote and oil.

During the past season regular reports have been made by the Meat Inspectors on all lines of pigs in which the percentage of tuberculosis or pleurisy has been unduly high. These have been referred by the District Superintendent to the Inspector of Stock in the district concerned so that conditions on the farm could be noted and advice given if necessary. The following are extracts from reports of Mr. E. A. McKinlay, Inspector of Stock, for Hamilton on some of the many farms visited, pleurisy up to 16 per cent. to 20 per cent. having been found in pigs raised on them: (1) Stores had been run in the open without houses for a time during a period of wet, cold weather. (2) Conditions very bad, poor draughty houses, pigs sleeping mostly in the open under trees. (3) One small house, many sleep in the open. (4) Unsatisfactory, no house or shelter. (5) House raised on piles and draughty, piggery exposed. (6) Heavy wet land, houses draughty, runs small and dirty.

In other instances conditions were good, but pigs had been bought at sales and seeds of disease already sown. It has been felt that feeding is an important factor in disease-control, particularly more complete feeding of the younger pigs, sufficient starchy foods in winter, and mineral supply. However, amongst those pig-farming successfully there is a wide diversity in feeding, including skim alone, whey and meat-meal, maize and roots, extensive grazing, and sty-feeding. The above reports suggest that poor housing and lack of shelter are two of the most important factors leading to excessive pleurisy.

Pigs can be reared free from pleurisy. A recent experiment at Ruakura, carried out by the Fields Division to test certain feeding-methods, concerned thirty pigs. These were raised to the eight-weeks stage on a standard milk-meal ration and thereafter run in different lots under different conditions of feed and management. Housing mostly was not elaborate, but draught-proof and floored. Paddocks or pens were reasonably sheltered and clean—used for pigs for the first time twelve months previously. Feeding was of various types after eight weeks, but milk and meal were fed at regular hours and in measured amounts. No cases of pleurisy were found on slaughter.

In a second instance, out of 120 pigs put through, only three were found to have pleurisy. The owner here was an enthusiast and a great believer in good housing and the value of bedding, which was changed daily and sometimes twice daily. The three pleurisy cases were believed to be three pigs which refused to sleep inside.

PREVENTION OF PLEURISY.

Prevention of pleurisy therefore appears to depend on attention to the following points:—

Housing.—The house must be tight-walled to be free from draughts, but ventilated below the roof, and have wooden floor; felt or wood beneath an iron roof keeps it warmer in winter and cooler in summer. Designs for houses are readily available. Provision of a concreted yard in front of the house is useful, particularly in wet country, as

pigs may be confined to the house and yard during very wet weather. Proper provision of *drainage* from the yard is essential to keep surroundings clean.

Shelter.—For the runs where the pen system is followed shelter is perhaps even more important for pigs than for other classes of stock. Outbreaks of disease and in pigs under record a marked check in rate-of-weight increase have been frequently observed during spells of cold southerly weather where housing and feeding were satisfactory, but runs badly exposed to bleak winds.

Shelter may take the form of artificial barricades of wood, iron, or scrub on windward side of runs or suitably close live hedges. Pampas requires fencing till established, but when mature makes a dense mass which is almost a substitute for a house.

Other points are cleanliness, avoidance of overcrowding, regular feeding, adjustment of amount of food to rate of growth, change of run where necessary, and the various other points summed up under the term "good management."

Peritonitis.

Peritonitis is inflammation of the membrane lining the belly-cavity, and covering the intestines and other abdominal organs. As seen at the works, it resembles pleurisy in that many cases show only the thickening of the membrane resulting from a previous acute attack, but "stripping" is necessary. The percentage of peritonitis was higher than usual last autumn, probably as a result of the wet summer. In the field it is frequently found associated with *Salmonella suipestifer* infection, and preventive measures will be dealt with under that head. It may follow post-castration infection.

Nephritis.

Nephritis is inflammation of the kidneys, acute or chronic. Bacterial infections, including *suipestifer*, have played a part.

Arthritis.

Arthritis, an inflammation of a joint, frequently the stifle, with excess discoloured synovia present, is also in many cases due to an infection, *suipestifer* having been found in some. A percentage of cases may be set up by bruising of the joint, possibly through climbing up on to feeding platforms.

Salmonella Suipestifer Infection.

Infection by *Salmonella suipestifer* is thus apparently an important factor in the production of the three previously named lesions, but it is also one of the chief causes of mortality in young pigs.

In suckers it is one cause of scours, if houses are contaminated and conditions dirty. In older pigs pneumonia is often present, evidenced by jerky breathing and loss of condition. Bowel-lesions are also common, either with pneumonia or independently, varying from small ulcers to extensive thickening—the so-called necrotic enteritis. The symptoms of this are usually chronic scour, marked loss of condition, pigs becoming skinny. Peritonitis is nearly always found in such cases. Deaths from a very acute infection may occur before the above signs develop, dead pigs often showing blue discoloration of belly and thighs

("blue belly"). The feature of *suipestifer* infection is the periodic occurrence of deaths, and the presence of odd, skinny unthrifty pigs showing the above symptoms. It is largely a dirt-disease, and infection becomes active where resistance is lowered.

PREVENTION AND CONTROL.

Prevention and control are in the direction of greater cleanliness, especially at feeding-places, change of runs if the ones in use are old and contaminated, and avoidance of overcrowding, which is a potent cause of spread. The obviously unthrifty pig which is merely distributing infection should be destroyed. Thoroughly clean out all milk-containers, add some lime, and for a period a daily amount of a chlorine disinfectant —say, a teaspoonful per 40 gallons. Feed a little whole milk to smaller pigs; cod-liver oil is useful. Access to good grazing often helps. Give necessary attention to housing. Small doses of sulphate of iron solution to suckers will check scouring.

Faulty Castration.

Castration is a surgical operation, incision being made into clean, healthy tissue, and healing should be rapid and uneventful. Occurrence of large tumour-like swellings points to infection. Castration should be carried out at an early age, and Waikato Recording Association pigs are usually castrated at three weeks old. It is essential that pigs should be clean when operated on, and imperative that for ten days afterwards they should be kept strictly clean, either confined to a clean house or preferably in a clean grass run, with clean house and feeding-space available. Do not apply strong antiseptics on or in wound, and rather use an antiseptic on skin before operation, preferably tincture of iodine.

Septic Wounds.

Septic wounds are the result of infection by dirt organisms of any wound or scratch. They may occur on any part of the body or limbs; about joints they may cause severe lameness. The infection may attack gums and lips of suckers. Many respond to treatment by first scrubbing the sore well to remove dead tissue, and then dusting with tartar emetic. Repeat in a week. If in the mouth, swab with iodine.

Overcrowding at feeding-places, quarrelsome pigs, excess barbed wire all tend to cause wounds, and filth harbours the infection. One may see such cases occasionally where pigs have quite a clean range on grass but come into some filthy pen for milk.

Summary.

Much of the loss due to the presence of tuberculosis in pig-carcasses could be prevented by more prompt detection and elimination of the dangerous cow in the dairy herd.

Condemnations and rejections for pleurisy, peritonitis, faulty castrations, and septic woulds could be lessened, and pig-mortality on the farm reduced, by attention to the following matters: Good draught-proof housing, with sufficient accommodation for all pigs and bedding in cold seasons; clean runs and feeding-places; correct feeding, particularly of the pregnant sow, and of the litter and weaner, along the

lines developed by recording clubs; adequate shelter for pens or runs; avoidance of overcrowding either in houses, in runs, or at feeding-places; temporary isolation of all newly bought pigs.

Good management comprises all the above matters, and also includes that little measure of interest in the pigs and attention to detail without which the best of plants may fail.

VINE-CULTURE UNDER GLASS.

(Continued.)

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The Treatment of Established Vines.

Climatic conditions vary so greatly in different parts of New Zealand that treatment which would be correct in one part is quite wrong in another. The climate of Auckland, some parts of Hawke's Bay, and of a few other localities is essentially different from that prevailing in the South Island and most parts of Wellington and Taranaki. It is evident that, in places where in summer the climate is almost tropical, more ventilation is necessary than is the case in cooler districts. It is a fact that the grape-vine will thrive in places having a much higher average temperature than is recommended for its culture in standard books on the subject. There is, however, a limit, and when the temperature under sun-heat rises much above 90° F. any further rise must be checked by increased ventilation. In most places where grapes are grown a much lower mean temperature prevails than is the case in the few warmer places mentioned.

In general practice it is inadvisable to make use of the bottom ventilators before the berries begin to colour. The effect of admitting bottom air while the foliage is wet has already been explained. In that case, however, young vines were being dealt with, a very different matter to that of established vines carrying a crop of fruit. Vines in full foliage and carrying fruit always hold more or less moisture on their surfaces. This is the case even where damping-down is of a minimum character, and there is danger in admitting bottom air if the outside air is appreciably colder than that inside the house. In warm districts and during calm weather this condition would not be present, therefore no harm would result from the use of the bottom ventilators provided obvious moisture had been first dispersed.

It is rare to find in this country vineries that are absolutely airtight. In most houses there is some space between the bottom pane of glass in each run and the sill; and this is a good feature, worth securing in all but the coldest districts. Air entering through these spaces passes up between the leaves and the glass. It has very little effect on the temperature in the house, but vastly improves the texture of the leaves, making them firm and leathery, a very desirable condition.

BEARING LATERALS.

The universal practice in the cooler districts is to leave only one lateral to each spur. Commercial growers usually train the rods more closely together than is the custom with private growers, and so secure a larger

number of smaller bunches. The system in other respects is the same in both cases. The one-lateral system is the only one by which the surface of the leaves can be properly exposed to the sun, which is a necessity in successful culture, and must be considered so in most situations. Besides this, the attention required in stopping, tying down, &c., is more handily given, and the suppression of pests is made as easy as possible.

Circumstances do sometimes occur where a departure from the rule of one lateral to the spur may be advisable. Cases are known where two, three, and four laterals have been left, each of which carries one or two bunches, which are well ripened. These cases are in the North, where the climate is such as to allow liberties not possible in most other places, and the houses are very large, so that there is a good body of air; and the borders are extensive, of the best of soil, and well fed. Though so far successful, this system cannot be recommended for general use. In most parts it would result in failure, while the same results could be secured by the safer plan of an increased number of rods and one lateral to each spur, which method will be followed in this series. None but experienced growers should depart from it.

ROUTINE WORK.

Pruning should be done in the early part of June, or earlier in warm districts, when all the principal leaves have fallen or would fall if the rods were shaken. Pruning should not be delayed when this stage is reached; the vines are benefited by a good rest, and, moreover, late pruning causes bleeding, with consequent weakening of the vines. Each lateral should be cut back to the base bud, the lowest prominent eye, cutting squarely across about $\frac{1}{2}$ in. above the bud. It is bad practice to cut close to the eyes. If this is done, and the vines break strongly, the laterals have not sufficient foothold and are liable to grow off, resulting perhaps in a barren spur.

After pruning, any loose bark on the rod should be stripped off, but bark which is not loose should not be removed. The practice of stripping off all the bark that can be removed is quite wrong: it weakens the vine and prevents the rods thickening as they should. If diseases or pests are present, washing or dressing the rods may be necessary: this is dealt with in a later section. If the rods are clean no dressing is required.

In spring the top buds have a tendency to break into growth before those on the lower part of the rods, and if this occurs the top laterals get ahead of the others and tend to so weaken those at the base of the rod that dead spurs result. To cause an even break, after being pruned and dressed, the upper half of each rod should be left loose, so that it may bend down in the form of a bow, and be kept in that position until the buds on the lower part of the rods have started to grow.

During the dormant period all the ventilators should be kept open; this ensures to the vines a thorough rest. This is one of the advantages of having the house reserved for vines, for when the house is shared by other plants ventilation is adjusted to their needs and higher mean temperature is maintained, which may cause the vines to start too early into growth in the spring. Except where vines are forced for early crops and heat maintained, it is not

desirable to start the vines until a steady rise in outside temperature may be expected. If vines are started too early a spell of cold weather may cause a check in growth, which is a result to be avoided.

When the time arrives for the vines to start growth the bottom ventilators should be kept closed. Syringing the rods, and so creating a moist atmosphere, is considered to assist the vines in breaking. When all the buds have broken and made a few inches of growth the rods should be suspended in their proper places. A good time to get the rods into their proper positions is when the shoots average from 4 in. to 6 in. in length. The tying-up of the vines requires to be done with care, otherwise laterals may be broken off. The risk is greater where the shoots have made much growth. The laterals rarely break quite evenly; some are more advanced than others.

As recommended earlier, each lateral should be pruned back in winter to the lowest prominent eye. In all but rare instances there are other dormant buds close to the one pruned to, which, though less prominent, will in some cases break quite as strongly as the one selected. The two strongest and well placed laterals on each spur should be kept until they have advanced in growth far enough to allow the selection of the one that promises to produce the best bunch of fruit. All but these two should be rubbed off as soon as the rods are suspended in their places, or as soon as they show after that time. When the final selection has been made the spare laterals should be broken off from their base.

The growth of the laterals at this time is very rapid, and, as it is highly important to prevent waste of growth, constant attention is necessary. Each lateral should be "stopped" at a point two leaves beyond the bunch of grapes nearest to the old rod. It may be that the second is the better bunch, and when this occurs it should be retained instead of the first. In such cases the lateral should be "stopped" at a point one leaf beyond the second bunch. In the case of close planting it may be necessary to stop at one leaf beyond the first bunch, so as to leave room for the extension of the lateral from its next break. In this case, if the second bunch is retained, stopping must be close to the bunch. This can safely be done to a limited extent, and, in fact, often is. There is no need for haste in selecting the bunches to retain; they do not become a drain on the vitality of the vine until the berries begin to swell. It is best to wait till the berries are set, as it sometimes happens that some bunches do not set well. Surplus bunches should, however, be removed before much swelling of berries takes place.

Where there is no fruit on any of the laterals on a spur, a well-placed lateral should be pinched back to one or two leaves and all new growth pinched back to one leaf. This lateral may then be pruned back in the winter to the base bud.

Stopping the laterals should be done by pinching off the tips with the thumb-nail. It is harmful to allow them to extend so that several joints have to be removed. The removal of a considerable amount of leafage, as would result from this practice, causes a severe check to the roots, and, what is far more important, the vitality expended in producing the extended lateral growth will have been lost.

Tying down the laterals is at times an operation requiring great care. If the laterals are stout they are extremely brittle, and are easily broken out of the spur. To bring such laterals safely down to the wire, hold the base of the lateral between finger and thumb of one hand and follow up the lateral with the finger and thumb of the other hand, giving a twist at each node sufficient to produce a crunching sound. After two or three twists the lateral can be bent down in safety. Where the trellis is a good distance from the roof tying down may be left till the base of the laterals becomes firm, as evidenced by a yellow appearance in the bark. The leaves must be kept clear of the glass, which may make it necessary to tie down a little at a time.

SUBLATERALS.

The treatment of sublaterals is a subject on which there is a wide divergence of opinion among experienced growers. In former times their extension was believed to be a necessity in promoting root-action. At the present time it is—and, indeed, has been for a number of years past—the practice of most commercial growers to suppress them altogether, breaking them out as soon as they show. It is held that if the vines grow strongly and make large leaves the sublaterals can be dispensed with. The advantage in doing this is a considerable saving of time, and in cases of close training it allows of a free passage of air among the leaves. An even spread of large leathery leaves is infinitely more valuable than any number of small and crowded leaves. One should be able to obtain an uninterrupted view between the foliage and the roof throughout the whole length of a fairly large house. If this condition obtains leaves will not be burned through pressing on the glass, and there will be no accumulation of moisture to cause burning and mildew, while the leaves, being exposed to light and suffering no injury, will be able to perform their normal functions properly.

SETTING AND THINNING OF THE BERRIES.

In this country there does not appear to be the difficulty in getting a good set of fruit that is experienced in the United Kingdom. No trouble of this kind has come under my notice except in cases where the vines had been badly treated or have been grown in a wet atmosphere. Varieties such as Lady Downe's and Muscat of Alexandria, reputed to be shy setters, have in my experience set quite freely. During the flowering-period the house should be kept rather dry—not entirely so, but "damping-down" should be moderate. Somewhere about midday vines of shy bearing tendency should be given a shake or jar just sufficient to cause a movement throughout the whole vine resulting in the dispersion of the pollen. The shaking should be repeated daily while the vines are flowering.

As soon as the berries are set they swell very rapidly. Surplus bunches should therefore be removed before the berries have swollen much, and should not be left for removal as thinning proceeds, as this would cause a waste of vitality. Varieties that are known to set freely may be thinned as soon as the blossoms fall, but shy setters should be left till the berries are the size of peas. The earlier thinning is done the easier it will be, and the better. If the berries crush each other before thinning is done the work is slow and difficult, and the berries will not afterwards attain full size.

There are different methods of thinning. The usual is to first remove unfertilized berries, and then ease the upper and crowded part of the bunch, removing the berries in the centre, and severely thinning those on the under-part of shoulders. A start is made at the bottom of the bunch, after selecting one berry to form the point. No exact rule can be laid down as to the number of berries to remove, this depending a good deal on the variety. Berries that have short footstalks require heavier thinning than those with long. John Wright, in the "Fruitgrowers' Guide," states the average

FIG. 6. YOUNG BUNCH OF GRAPES, WITH ONE SIDE THINNED.

number to remove is two-thirds on the lower parts of the bunch, half at the middle, and one-third at the top. This, however, must not be accepted as a fixed rule. Experience is the only satisfactory guide.

Thinning is usually done in amateurs' vineries with scissors made for the purpose, a button-hook or a forked stick being used to hold the sprays in convenient positions. Where there are distinct shoulders to the bunches these should be raised somewhat by strands of raffia fastened to the trellis. This should be done before thinning the bunch is commenced, as it permits the leaving of berries that would otherwise have to be removed, because they would be smothered by the shoulder. Commercial growers generally cut out all the loose shoulders before commencing to thin.

A quicker and less tiring method is to place one hand behind the bunch and pick out the berries with the other hand. The scissors cannot be entirely dispensed with. They are necessary for cutting diseased or damaged grapes out of ripe bunches when handling would spoil the bloom on the grapes.

(To be continued.)

FACTORS RELATING TO THE CONTROL OF SOFT-SCALD IN JONATHAN APPLES.

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DURING the past four years cold-storage experiments have been carried out in co-operation with the Department of Scientific and Industrial Research and the New Zealand Fruit-export Control Board with a view to determining the causal factors over a wide range of circumstances and conditions contributing to wastage in Jonathan apples.

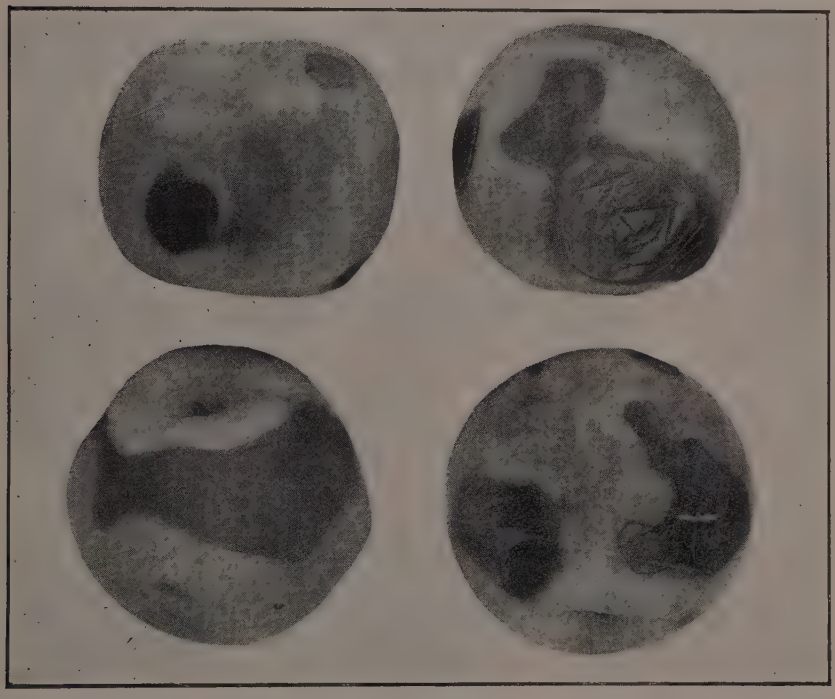

FIG. I. SHOWING SOFT-SCALD IN FOUR STAGES OF DEVELOPMENT ON JONATHAN APPLES.

Overseas surveys(1), (2) have produced evidence that although the various types of wastage may be very slight when the apples are discharged at the docks, there may be a rapid development during the marketing period. The longer the marketing period, the larger and more mature the fruit at the time of discharge, the greater the amount of wastage.

The Jonathans concerned in the experiments were forwarded to cool storage in the Dominion through the usual channels as obtaining in export, and the examinations were conducted at such times as to

reproduce conditions comparable with a shipment arriving at its overseas destination and marketing of the apples subsequent to discharge.

Diseases causing Wastage in Jonathans.

Soft-scald.—Although soft-scald varies in its incidence from season to season, and in some seasons it is entirely absent, it is often the cause of more or less serious loss.

The disease, which usually makes its appearance comparatively early in the storage life of Jonathan apples, or shortly after their removal to atmospheric temperatures, is recognized by a browning of skin and underlying flesh, and, while in the early stages only a small area or a mere spot on the apples may be affected with scald, it spreads in an irregular formation and eventually covers the whole surface to varying depths into the flesh of the fruit.

Fungal Rotting and Internal Breakdown.—In our experiments with Jonathans very rarely have these two types of wastage been very serious when the samples were removed from cold storage, but they have developed in varying amounts as the fruit ripened.

The results have indicated that soft-scald is a very serious storage disease in Jonathans, and, while it varies in its incidence from season to season, susceptibility to the disease may likewise vary in fruit from different localities and orchards in the same locality.

Table 1.—Showing Seasonable and Locality Variations in the Occurrence of Soft-scald, Internal Breakdown, and Fungal Rotting Fourteen Days subsequent to Removal from Cold Storage at 37° F.

Locality.	Soft-scald.			Internal Breakdown.			Fungal Rots.		
	Season 1933.	Season 1934.	Season 1935.	Season 1933.	Season 1934.	Season 1935.	Season 1933.	Season 1934.	Season 1935.
	%	%	%	%	%	%	%	%	%
5	6	Nil	..	1	5	..	3	..	..
6	Nil	,,	8	1	Nil	1	2	Nil	5
7	8	,,	12	4	,,	Nil	6	3	8
8	1	,,	1	Nil	,,	,,	Nil	Nil	1
9	Nil	,,	10	2	,,	,,	2	,,	4

The variation in wastage in Jonathans from season to season and from different localities is well marked. There was clearly an association between soft-scald and fungal rotting. Plagge, Maney, and Pickett(3) believe that the disease is identical with soggy breakdown, the chief differences between soggy breakdown and soft-scald being in appearance only. Although our results are in agreement that both diseases are due to low storage temperatures, and influenced by time of picking and undue delay before storing, the suggestion that the development of the disease stops when the fruit is removed from storage is contrary to our findings, for while, as with internal breakdown, soft-scald may have made very little or no development when the apples are removed from storage, it may increase very rapidly on exposure to atmospheric temperatures.

Table 2.—Showing the Influence of Temperatures of Storage on the Development of Wastage in Jonathan Apples Fourteen Days subsequent to Removal from Storage.

(The figures give the average wastage for three seasons in apples which were sound on removal from storage at 34° F. and 37° F. respectively.)

Soft-scald.		Internal Breakdown.		Fungal Rots.	
Temperature 34° F.	Temperature 37° F.	Temperature 34° F.	Temperature 37° F.	Temperature 34° F.	Temperature 37° F.
% 8	% 3	% 2·5	% 2·5	% 1·5	% 1·5

This result indicates that although soft-scald varies in its incidence —during some seasons it is entirely absent (Table 1)(4)—it constitutes the greatest amount of wastage in Jonathan apples; and therefore, as the figures show, the disease may be reduced to a minimum by storage or transport at a relatively high temperature.

To show (Table 3) a further result of the influence of relatively high temperatures in the control of soft-scald in Jonathan apples in 1933—regarded as a susceptible season—comparable samples of counts 198, 180, and 163 were obtained from three localities and stored under three sets of temperature conditions—viz., 34° F., 37° F., and at temperatures as obtaining in a precooler where large quantities of fruit were being loaded in and out daily, the temperatures varying from 42° F. to 32° F., the higher generally prevailing.

Table 3.

Soft-scald.		
34° F.	37° F.	42–32° F.
% 10	% 2·4	Nil

Although the effect of relatively high temperatures(5) has been pronounced in scald control, susceptibility to the disease may be increased by prestorage factors.

Delayed Storage.

Delaying storage for ten days after gathering increased the disease and reduced the general storage life of Jonathans.

In this experiment the samples were gathered from the same trees at two stages of maturity. The second picking was made ten days later than the first, and, while half of the samples was placed in cold storage immediately, the other half was held in a packing-shed for ten days before being cold-stored under the same conditions as the first lot.

The experiment was carried on for four seasons, and, although each year the samples varied in susceptibility to soft-scald, the disease was always greater in its incidence in the delayed-storage samples from both the first and second stage of maturity.

Table 4.—Showing the Effect of Immediate and Delayed Cold Storage in the Control of Soft-scald.

First Picking.		Second Picking.	
Immediate Storage.	Delayed Storage.	Immediate Storage.	Delayed Storage.
%	%	%	%
2	5	3	8

The influence of placing Jonathans in cold storage with as little delay as possible was significant in reducing the amount of soft-scald, and, while there was very little difference in the amount of scald in the samples picked at an interval of ten days and stored immediately, the evidence indicated in both samples that delayed storage renders the apples less resistant to the disease. In addition to scald these samples were over-ripe, showing a tendency to breakdown and fungal rotting, and decidedly past their best marketing-condition.

Oiled Wrappers.

The effect of oiled wrappers in the control of soft-scald gave discouraging results. In the experiments, wrapping Jonathans in oiled wrappers as against comparable samples without wraps or in standard wraps did not give any appreciable control of scald. The writer is of the opinion expressed(6) that the term "soft-scald" is misleading in that it is not related to the trouble generally known as superficial scald, but rather to a form of external breakdown.

Packing-wraps.

Following the introduction of the one-piece-all-round corrugated wrapper for lining apple-cases and the unexpected development of soft-scald in Jonathans packed in the all-round wrapper, an investigation was undertaken to test the suggestion that the disease may be due to the same cause as superficial scald(7)—the accumulation of volatile substance brought about by the wraps restricting ventilation.

The experiments were arranged with Jonathans from a number of localities. These were packed in cases lined with the one-piece corrugated wraps, and the results subjected to comparison with comparable samples packed with strips of the corrugated wraps at the top and bottom only, and also no case lining.

As with oiled apple-wraps, the corrugated wrap treatments under review gave negative results in so far as the incidence and control of soft-scald is concerned.

Table 5.—Showing the Influence of Wrap Treatments on the Development of Soft-scald.

Experiment No.	Storage Temperature.	All-round Wraps. Soft-scald.	Top and Bottom Pads. Soft-scald.	No Wraps. Soft-scald.
	°F.	%	%	%
1	37°	5	5	4
2	37°	1	1	No test.

As this result is the average percentage of soft-scald for six cases of Jonathans in each experiment, the 1 per cent. less scald in the no-wraps treatment is not significant, and does not warrant any suggestion that the one-piece wrap is a factor in the development of the disease.

Fertilizer Treatment.

Over a period of four years an examination of Jonathans from plots which received a combination of fertilizer treatments* in addition to the commercial application gave inconsistent and discouraging results with regard to overcoming susceptibility to soft-scald.

The influence of fertilizer treatments was most pronounced in crop-production, the trees yielding from five to eight cases of large-sized fruit 2½ in. to 3 in. each year, and there was some evidence that the additional manurial application resulted in the Jonathans being of a rather soft nature.

Rainfall.

The results secured indicated that heavy rain towards the end of the growing-season rendered the apples more susceptible to soft-scald. During the seasons 1930 and 1933, when the rainfall for the two months preceding picking amounted to 11 in. and 9·5 in. respectively, the disease was more serious than in other seasons when the rainfall was not so great. The influence of heavy as against light soils was not significant with regard to the development of the disease, and contrary results were obtained; some seasons scald occurred in the samples from heavy soils, and the following season, while the samples from the heavy soils were almost free from the disease, those grown on light soils were affected.

Summary.

(A) Jonathan apples vary in susceptibility to soft-scald from different localities and from season to season.

(B) Storage of Jonathans at low temperatures increases susceptibility to soft-scald.

(C) Delayed storage or cooling of mid-season and late-season more mature Jonathans increases susceptibility.

(D) Wrapping the fruit in oiled as against standard and without wraps did not appreciably control the development of soft-scald.

(E) Fertilizer treatments of the soil gave inconsistent and discouraging results in overcoming susceptibility to the disease.

(F) An increased amount of rainfall towards the end of the growing-season renders the apples more susceptible to soft-scald.

Control Measures.

Jonathans picked when they are mature (not immature or over-mature) are the least liable to soft scald.

Immediate cooling after gathering is recommended as a control measure.

Cold storage at relatively high temperatures (36° F. to 38° F.) provides a maximum of control.

* Commercial application applied to all the experimental trees: Basic superphosphate, 7¼ lb.; sulphate ammonia, ½ lb.; sulphate potash, 1¼ lb.; bonedust, 1 lb. Plot additions: (1) Sulphate ammonia, 2 lb.; sulphate potash, 2 lb. (2) Sulphate ammonia, 2 lb.; superphosphate, 2 lb. (3) Sulphate potash, 4 lb. (4) Superphosphate, 3 lb. (5) Sulphate ammonia, 4 lb.

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THE GYROTILLER.

EXPERIENCE IN SOUTH CANTERBURY.

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A GYROTILLER commenced contracting in South Canterbury in April, 1935, and carried on throughout the winter and spring, working its way up from Waimate County through Levels and Geraldine, and left the district during September, returning again for a short period in October and doing further work in Levels. The itinerary of the machine is mentioned because it has a definite bearing on the results obtained in various parts of the district. The other factor which has brought about diverse results, and in many cases discredited the implement, are the claims made by the owners without having given due regard to the object of the cultivation, the season of the year, the state of the field, and the subsequent crop.

The farming community react in only two ways to any new innovation which is destined to interrupt their ordered or usual farming operations. They either treat the innovation with caution and have nothing to do with it until ample proof is available or they adopt the innovation wholeheartedly. In South Canterbury the gyrotiller was adopted immediately. The machine itself commands respect, if only from an engineering aspect; its depth and width of tillage seemed (and are) admirable for the type of soil in the district, being, as it is, for the most part, clay loam overlying a stiff clay subsoil. These, together with the claims of the owners of the machine, which were that up to 50 per cent. increases had been obtained by the use of the deep tillage due to the opening-up of fresh supplies of plant-food, and also that little or no cultivation was required after the gyrotiller had been used, persuaded the farmer to have contracting done irrespective of the most important matters mentioned in the last part of the preceding paragraph.

It was disregard of these matters that has caused any dissatisfaction which exists to-day regarding the work of the implement in South Canterbury. The proof of this lies in the fact that the farther north the machine went from Waimate the stronger the dissatisfaction with the results. As the machine went north, the later in the season was

the cultivation being done, and consequently less and less time elapsed between the cultivation and the sowing of the crop. An extreme case, and one where the dissatisfaction is the worst, is where the land was tilled out of lea in late September with the object of sowing swedes in November. The consequences of such an effort on the subsequent crop are obvious.

It will be assumed rightly from the foregoing that a doubt exists in South Canterbury to-day as to the usefulness of the gyrotiller. Really there is no doubt at all about the efficiency of the implement: used properly, the machine does effective work.

THE GYROTILLER.

As has been the case with many innovations in agriculture of recent years, over-enthusiasm and lack of attention to the first principles of agriculture have been the cause of discrediting the gyrotiller in some parts. Had the owners of the machine given due regard to the object of the cultivation, the season of the year, the state of the field, and the desired crop, instead of creating the feeling that the machine overcame all difficulties, the position to-day would not have arisen. Briefly, eagerness not to miss work last season will be a great hindrance to getting work this year in the northern parts of South Canterbury.

In the Waimate district, where contracting commenced in April, farmers had the work carried out with the object of putting the ground into potatoes, and results have been excellent. There is, however, no reliable way in which comparison of results on gyrotilled and on ordinary

cultivated land can be made. Cultivation in April on lea land with the object of sowing in September–October allows weathering and sweetening to take place, and this is absolutely essential where such a depth of soil is tilled and aerated for the first time. The weathering reduces the clods, and plenty of time elapses to rot the turf and make it available for the crop. It was a noticeable fact with the dry spring experienced that the gyrotilled potato crops held out better than others, while it was also said that drainage was better during the heavy rains following. Yields from the tilled land are most encouraging, and will probably average 15 tons an acre. Certified seed was sown in practically all the gyrotilled land, with superphosphate 3 cwt. an acre and sulphate of ammonia 1 cwt. an acre as the manure.

Outside the Waimate district the cultivation was carried out mostly with the object of putting the ground into swedes, turnips, and rape. Oats, however, were sown on some tilled land with fair success. Some excellent crops of swedes have been obtained where the work was carried out in early winter. As the machine has worked north and the season progressed, the results fall away, and some very poor crops are to be seen. It is noticeable, however, that in some cases where a certain amount of cultivation had been done prior to late gyrotilling the resultant crops are quite good, although the crop varies considerably from the sides to the centre of each width of the machine. The cause of this is that the rotary tynes have a tendency to bring up unweathered soil from below to the centre and transfer all the good soil to the outside edges of each width of the machine. This gives a crop, where the tilling has been done late, an undulating appearance. This feature is not noticeable in the Waimate district.

Lessons from the Experience.

The lessons to be learnt from the first year's working of the gyrotiller in South Canterbury are as follows:—

(1) Cultivation for any crop on any class of land should be carried out as early as possible. The following is suggested for crops following lea:—

If tilling is carried out for wheat in January or February, previous top-work can be dispensed with. After these months, tilling should be done only on land that has been skimmed or "hustled" earlier. No tilling should be done later than the middle of April. If rain fell on this later tilling it would be impossible to sow the wheat in the winter of that year because the land after tilling lies very open and cannot carry either horses or tractor for some considerable time. For potatoes and oats direct tilling should be done only up to the end of May. After that, tilling should not be done unless the top-work has been carried out earlier. In this case the tilling should be completed before the end of June. For rape, turnips, and swedes direct tilling can be done up to the end of July, and after that only on previously worked land up to the end of August.

(2) Direct late-tilling for any crop on a lea field has resulted, in the main, in the failure of the crop. This can be attributed to—

(*a*) The mixing of unweathered soil with the topsoil and consequent temporary sourness;

(*b*) Lack of consolidation due to the stirring and opening-up of a considerable depth of soil;

(*c*) The impossibility of reducing the topsoil to a sufficient tilth for a suitable seed-bed after tilling—due to the fact that as there is such a quantity of loose soil the lumps run in and out of the tines of the implements doing the top-work without causing any pulverization.

To ensure a successful after-crop it is advisable to gyrotill early to allow the top to sweeten and consolidate, and then to cultivate the top 4 in.–5 in. into a sufficient seed-bed for the reception of the particular crop desired, remembering that gyrotilling does not do away with the necessity of manuring the crop on the approved lines.

The effect of the deep cultivation in subsequent years has still to be observed. It seems, however, that it should be of great benefit in freeing the stiff clay of the South Canterbury Downs, resulting in better drainage and easier root-development of the plant.

On land infested with the more difficult twitches, such as creeping-fog and couch, yarrow, and other underground creeping plants, gyrotilling should not be done unless an absolute bare fallow is to be carried out for the following six or eight months. The action of the tillers mixes to a considerable depth much of the top turf, thus preventing the eradication of the rhizomes. On such land cleaning on the usual approved lines should take place before tilling.

Gyrotilling should not take place on land to be sown into grass that season. Lack of consolidation will result in a failure of the grass to establish.

One of the most useful features of the implement is the manner in which it can successfully deal with the corners of fields, neglected fence-lines, and isolated areas infested with gorse, blackberry, or broom of almost any height. It can till such places considerably more cheaply and more effectively than they can be cleared and ploughed by the usual methods.

Relation between Gyrotilling Contract Work and the Cost of Crop Production on the Farm.

It can be definitely stated that gyrotilling at the correct time increases the cost of production of the subsequent crop. The operation purely from a tillage viewpoint only does away with the usual ploughing operations—that is, skimming and deep-ploughing—the amount of top-work that has to be done after either method to procure a suitable seed-bed being approximately the same. Thus, allowing for skimming and cross-ploughing at 8s. 6d. per acre and deep-ploughing at 10s., the cost of production is increased as by gyrotilling £2 10s., less cost of ploughing operations £1 7s.: increased cost of production equals £1 3s. per acre. As to whether this increased cost of production per acre is offset by an increased yield sufficient to lower the cost of production per unit, whether it be a bushel of wheat, oats, &c., or a ton of potatoes or roots, is at present not known, as there is no reliable information available on the subject.

However, considering the class of work done, it would be unreasonable to charge the immediate subsequent crop with the whole cost of the gyrotilling operation. The work performed is of such a nature that its beneficial effects are likely to be felt for many years after the work has been done. A parallel case would be the effect of lime.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR THE YEAR 1935–36.

BUTTER-MANUFACTURING companies which have obtained for their export produce an average grade of 94 points or over, and cheese-manufacturing companies which have obtained an average grade of 93 points or over, are listed below.

Butter and cheese factories total thirty-two and twenty respectively, of which twenty-two butter and eleven cheese are situated in the North Island and ten butter and nine cheese companies in the South Island.

Butter-factories.

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Inter-Wanganui Co-op. ..	6	Inter-Wanganui ..	215	94·872
Kaikoura Co-op. ..	302	Kai	167	94·869
United Co-op.	1220	Whariti	328	94·794
Karamea Co-op. ..	1570	Karamea	30	94·787
Awahuri Co-op. ..	664	Red Rose	990	94·770
Rangiwahia Co-op. ..	750	Quail	144	94·761
Kokatahi Co-op. ..	1144	Kokatahi	157	94·659
Golden Bay Co-op. ..	146	Sovereign	554	94·635
Levin Co-op.	910	Lake	1,659	94·630
Murchison Co-op. ..	1888	Airship	205	94·616
Rangitikei Co-op. ..	1360	Rangitikei ..	703	94·613
Lepperton Co-op. ..	49	Lepperton	285	94·557
T. and P Milk-supply Co., Ltd.	54	Sweet Briar, &c. ..	16	94·557
Shannon Co-op. ..	1489	Shannon	1,179	94·512
Collingwood Co-op. ..	1254	Golden Hills ..	206	94·505
Tamaki Co-op... ..	1463	Bell	474	94·460
Wangaehu Co-op. ..	1326	Wangaehu ..	637	94·438
Rata Co-op.	938	Rata	1,141	94·429
Golden Coast Co-op. (Maruia Branch)	387	Golden Dawn ..	37	94·413
Uruti Co-op.	300	Uruti	245	94·338
Rongotea Co-op. ..	8	Rongotea	956	94·294
Kuku Co-op.	905	Ohau	277	94·292
Midhirst Co-op. ..	110	Rugby	1,337	94·284
Rodney Co-op... ..	394	Rodney, &c. ..	511	94·283
Tikorangi Co-op. ..	102	Shield	432	94·283
Ruawai Co-op. ..	66	Ruawai	1,398	94·195
Arahura Co-op. ..	1516	Arahura	95	94·182
Masterton Co-op. ..	1307	Masterton ..	916	94·178
Taihape Co-op. ..	1188	Tikapu	611	94·158
Mangorei Co-op. ..	345	Mangorei	930	94·155
Eketahuna D. Co. ..	46	Eketahuna ..	179	94·109
Waitara Co-op. ..	726	Waitara	514	94·105

Cheese-factories.

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Omimi Co-op.	74	Omimi	63	93·679
Westmere Co-op. ..	1621	Westmere ..	325	93·669
Kaimata Co-op. ..	992	The Oaks	320	93·592
Marton Co-op. ..	660	Marton	25	93·531
Melton Co-op.	1030	Milton	108	93·531
Little Akaloa Co-op. ..	32	Little Akaloa ..	44	93·426
Stirling Co-op. ..	292	Stirling	340	93·400
Rapanui Co-op. ..	1714	Southern Grove ..	131	93·366
Bell Block Co-op. ..	71	Dove	164	93·288
Lowgarth Co-op. ..	629	Lowgarth	520	93·276
Barry's Bay Co-op. ..	401	Onawe	254	93·230
Kahui Co-op.	493	Kahui	262	93·181
Rai Valley Co-op. ..	519	Rai Valley ..	311	93·153
Newman Co-op. ..	966	Newman	189	93·124
Wairewa Co-op. ..	471	Wairewa	148	93·090
Bell Block Co-op. ..	488	Bell Block ..	393	93·071
Kaitangata Co-op. ..	1648	Kaitangata ..	124	93·069
Cardiff Co-op.	10	Cardiff	620	93·050
Cloverlea Co-op. ..	64	Cloverlea	134	93·022
Kai Iwi Co-op... ..	1565	Kai Iwi	101	93·006

—*Dairy Division.*

RECENT REGULATIONS AFFECTING FARMERS.

THE following notes on regulations made under the several Acts mentioned below are of general interest to farmers:—

AGRICULTURE (EMERGENCY POWERS) ACT, 1934.

By the Calves (Sales for Slaughter) Regulations, 1936, which came into force on 18th June, the sale and collection of young calves intended for slaughter for human consumption as boneless veal is regulated with the object of safeguarding New Zealand's export trade to the United Kingdom in this class of meat. The regulations are aimed at ensuring that such calves are properly fed from birth and are sufficiently matured for sale and collection for slaughter. Incidentally, the regulations are intended to prevent any appearance of cruelty to such calves by reason of the failure on the part of dairy-farmers properly and sufficiently to feed them from birth and until disposal, or by reason of their unfitness on account of apparent weakness or immaturity to be driven or conveyed to the place of slaughter.

By the Dairy Industry Accounts Regulations, 1936, standardized forms of balance-sheets, accounts, and directors' reports for co-operative dairy companies are prescribed, and, commencing with the current manufacturing season, the directors of every such dairy company are required to prepare their report with respect to the state of the affairs of the company and the balance-sheet, manufacturing and marketing account, appropriation account, and statement of statistics of the company in the several forms prescribed and in accordance with the directions and instructions contained therein. The directors must attach to their report a copy of the balance-sheet and of each of the other prescribed accounts and documents.

All co-operative dairy companies and those non-co-operative dairy companies that send to their suppliers (whether shareholders or not) statements, reports, or accounts relating to their manufacturing operations are required to send to all suppliers—

(*a*) A report giving in respect of the previous year the estimated season-average pay-out per pound of butterfat which was quoted in the report for that year and the actual season-average pay-out that

was finally made, and giving, in respect of the current year, the valuation basis for dairy-produce unsold and the estimated season-average pay-out which should result from the disposal of unsold dairy-produce at the values adopted ; and

(*b*) A balance-sheet, manufacturing and marketing account, appropriation account, and statement of statistics compiled in accordance with the standard forms, together with a copy of the special form of Audit certificate set out in clause 3 of the regulations.

Owners of proprietary dairy companies and private owners of dairy factories are required to send to every supplier a statement containing the same information and particulars as is required of co-operative dairy companies respecting the pay-out to suppliers for the past and current seasons, and such statement must be supported by the special form of Audit certificate set out in clause 3.

Copies of all documents which by the regulations are required to be sent to suppliers must also be sent to the Acting Director of Marketing and to the Director of the Dairy Division of the Department of Agriculture.

By the Dairy-produce Levy Regulations, 1936, the Dairy-produce Export Levy Regulations, 1935, are revoked, but the existing charges fixed by the New Zealand Dairy Board by way of levy on dairy-produce intended for export continue to apply to all dairy-produce manufactured before 31st July but exported after that date, and shall be collected by the Customs Department as theretofore.

The new regulations prescribe the same maximum levies that were prescribed by the revoked regulations, but although the amount of the levies that may be imposed applies only to butter and cheese manufactured on and after 1st August such levies have been extended to include butter and cheese so manufactured, whether intended for export or for sale for local consumption. All moneys payable by way of levy on butter and cheese so manufactured and intended for export are payable to the Primary Products Marketing Department and shall be deducted from moneys payable to owners whose produce has been acquired by the Crown pursuant to the Primary Products Marketing Act, 1936. All moneys payable by way of levy on butter and cheese so manufactured and sold for local consumption are to be paid to the Department on demand, and for that purpose every manufacturer, being the owner or occupier of a creamery, cheese-factory, or whey-butter factory, who sells for local consumption any butter and/or cheese that has been manufactured after 1st August is required to furnish to the Department a monthly return of all produce so sold. Alternatively, such moneys may be deducted from moneys payable to the manufacturer in respect of any butter and/or cheese acquired from him pursuant to the provisions of the Primary Products Marketing Act. The residue of all moneys received by the Department in respect of such levies, after making a deduction of 1 per cent. thereof to defray the cost of collection, shall from time to time be paid to the Board.

The Stock Act, 1908.

By amending regulations under the Stock Act, which came into force on 23rd July, all cattle imported from Canada, the United States, or Tasmania (being the countries from which cattle may be imported into the Dominion) must be tested prior to importation with the Johnin test to determine whether they are affected with Johne's disease. The amending regulations also provide for the admission of horses, sheep, or dogs from the South-western Division of the State of Western Australia subject to reasonable safeguards against the introduction of disease into the Dominion.

The Seeds Importation Act, 1927.

By the Seeds Importation Regulations, 1929, Amendment No. 1, which came into force on 23rd July, Government certified perennial rye-grass seed may be imported from any country without being stained prior to importation in accordance with the provisions of the principal regulations.

—*A. E. Morrison, Solicitor, Department of Agriculture, Wellington.*

AGRICULTURAL STATISTICS, 1935–36.

Statistics for the season 1935–36 are now available, and figures for the principal items are here given, last year's figures being shown also for purposes of comparison.

Attention is directed to the fact that the crop figures relate only to holdings of 1 acre or over located outside borough boundaries. The live-stock figures, on the other hand, include allowances made for live-stock in boroughs and on holdings of less than 1 acre in extent.

PRINCIPAL CROPS.

Name of Crop.	Areas.		Yields.		
	1934–35.	1935–36.	Unit.	1934–35.	1935–36.
Wheat—	Acres.	Acres.			
For threshing ..	225,389	248,639	Bushel	5,933,245	8,859,223
For chaff, hay, or ensilage	2,230	2,075	Ton	3,997	3,862
Fed off or cut for green fodder	2,904	1,709	..	..	..
Oats—					
For threshing ..	52,516	77,502	Bushel	1,890,145	3,302,642
For chaff, hay, or ensilage	222,100	227,480	Ton	315,589	390,168
Fed off or cut for green fodder	61,802	58,314	..	..	..
Barley—					
For threshing ..	18,441	20,659	Bushel	484,689	745,380
For chaff, hay, or ensilage	753	923	Ton	1,547	1,895
Fed off or cut for green fodder—	9,537	6,195	..	..	..
Maize—					
For threshing	7,946	7,517	Bushel	373,219	321,222
For ensilage	438	558	Ton	2,980	4,149
Fed off or cut for green fodder	7,716	9,051	..	..	..
Peas for threshing ..	25,366	24,428	Bushel	436,534	562,733
Linseed for threshing ..	2,930	1,806	Cwt.	17,208	11,535
Potatoes	23,001	22,958	Ton	109,123	*
Onions	923	928	,,	5,592	7,089
Rye-grass, harvested for seed—					
Perennial	54,012	53,552	Lb.	17,117,118	19,473,245
Italian and Western Wolths	12,436	13,073	,,	4,800,514	6,160,949
Cocksfoot harvested for seed	12,309	13,516	,,	1,876,386	2,374,909
Grasses and clovers cut for hay	404,156	453,353	Ton	744,272	851,263
Grasses and clovers cut for ensilage	80,595	82,665	,,	323,854	334,759
Lucerne cut for hay or ensilage	39,087	40,857	,,	115,005	118,479
Turnips (including turnips and rape mixed)	449,513	441,854	..	..	..
Mangels	11,211	13,210	..	..	..
Tobacco	1,358	1,518	Lb.	1,106,424	1,065,693

* Not yet available.

SEASONAL NOTES.

THE FARM.

Co-ordinate Phases in Grass Farming : Utilization and Production of Feed.

At times neighbouring farmers working with pastures and stock which are essentially similar obtain very different returns from identical top-dressing programmes. One of the factors which readily may cause the different results is of particular current importance. It arises from the fact that top-dressing normally results in the production not only of extra feed when it is badly needed, but also of extra feed at seasons when there would be ample feed without top-dressing. If this latter additional feed is not appropriately used, and if it is allowed to lead in spring and early summer to the development of coarse stemmy growth, then the good done at one season by top-dressing may be nearly, or even more than wholly, counterbalanced by the undesirable results at the later stage. In short, really judicious autumn or spring top-dressing may be far from fully effective because its subsequent influence is not controlled or modified suitably. Hence farmers at times condemn top-dressing without any true justification for doing so. Consideration of their experience usually shows that top-dressing has done all that it reasonably could be expected to do—it has given additional feed. The farmer who disparages his top-dressing under such circumstances is in error ; it is he who has failed—failed in not linking the top-dressing with other measures which enable the extra growth that has been produced to be utilized properly.

Incidentally, the benefit from any other practice which, like top-dressing, begets increased summer pasture-growth may be restricted, or even eliminated, by inefficient utilization of the feed available.

One phase of this matter which warrants further consideration is that the results of poor utilization comprise not merely poor returns from the feed produced but also frequently include deterioration of the sward and a consequent decline in its productive capacity. This is because poor utilization of grassland usually involves both too light grazing in the late spring and summer and over-grazing in the winter and early spring—a type of grazing-management which tends to the progressive weakening of the species which produce feed early in the season and a strengthening of those which make late growth. In the mixed pastures characteristic of very extensive areas, this tends to the suppression of perennial rye-grass and the dominance of species akin to brown-top and sweet vernal. In short, there is growing evidence that generally conditions of soil and climate do not determine the botanical composition of a pasture so completely as is often believed, and that frequently the method of grazing is the real determining factor. While this generalization is not valid in respect to extremes of soils and climates when the influence of grazing management may be counterbalanced or masked by the greater influence of soil or climate, it is, nevertheless, so widely valid as to warrant more attention by farmers to the utilization of the growth of pastures. Production of feed is only one phase of farm-management, and if production of feed is not linked with suitable utilization it is certain that the fullest possible returns will not be obtained.

An important cause of this result is that poor utilization, apart from its harmful effect on the pastures themselves, leads frequently to stock being fed badly at two critical periods each year, whereas by good utilization an equal number of stock could be relatively well fed without increasing the total amount of feed available ; under poor utilization the supply of feed normally is not only wastefully excessive but also lacking in quality

in the early summer, while in winter and early spring the failure commonly is quantitative. This is primarily because 70 per cent. or more of the feed directly available from grassland is produced during the spring and early summer. When utilization is not good a common result of this is the following of a half-way course or compromise in regard to the number of stock carried. This half-way course often brings about an unsatisfactory position both in the period of highest production and in that of lowest production—understocking in the former period, overstocking in the latter.

Utilization Relatively Neglected.

Rightly during recent times much thought and effort have been given to the task of increasing the production of grassland until on many farms the production of pasture-growth is more efficient than its utilization. A most important feature of the position is that many farmers do not realize that their utilization is relatively inefficient in the light of current knowledge.

One of the principal causes of poor pasture-utilization is the allowing of the growth to become too mature and stemmy during spring and summer. The coarse stemmy growth is poor in three characteristics in which feed suitable for butterfat-production and for fat-lamb production requires to be good—the stemmy growth is poor in milk- and flesh-forming compounds called proteins, poor in mineral matter required for milk-and bone-formation, and poor in digestibility. For long it has been well known that very unsatisfactory results come from grazing sheep on pastures of considerable length and maturity, and particularly in recent years has it been realized that the grazing of coarse stemmy pastures is similarly undesirable for dairy cattle. To some, these facts are so well known that the statement of them may seem scarcely worth while. But they are important facts, and thousands of farmers continue to ignore them in their farm practices.

Means to Good Control of Pastures.

Commonly the avoidance of excessive stemminess or maturity of pasture-growth calls for the adoption of two complementary practices—systematic grazing and ensilage.

On many farms the essential steps in systematic grazing are the following simple ones: (1) Rapid grazing of individual fields by relatively heavy stocking so that each grazing period is usually of from one to three days; (2) subsequent "spelling" of the fields sufficient to again give the amount of feed required for the grazing period already specified, and this without punishing either stock or swards.

Often reasonably good grazing-management can be secured on farms subdivided into from nine to twelve paddocks exclusive of specially small paddocks used by pigs, calves, &c.

To enable successive grazings to take place at a suitable stage of growth it becomes necessary from time to time to omit from the grazing any paddocks in excess of those needed to meet the current feed requirements of the stock. It is the omitting of these paddocks that provides the material for ensilage, for as the season progresses usually more paddocks are dropped from the grazing than can be handled satisfactorily in haymaking.

The needs of the position may seem so obvious and simple as to make it somewhat surprising that they are so often neglected in practice.

Surely it is fortunate that ensilage, one of the most effective means of avoiding badly controlled grazing of pastures in late spring and early summer, is also one of the most economical ways of providing for better winter-feeding of stock.

Usually ensilage should be supplemented by some haymaking, partly because when any good haymaking weather is experienced haymaking may be just as efficient as and less laborious than ensilage, and partly because hay is more suitable as a complementary feed to roots than silage.

Control of pasture growth in spring and summer is facilitated by grass-harrowing, which, by evenly distributing stock droppings, assists in eliminating patches of coarse rank growth. Further information about the methods of effective grazing-management at this season may be obtained from local officers of the Fields Division.

Two important matters relative to ensilage that may need attention at this season are—(1) The closing-up of suitable pastures as discussed in last month's notes; (2) the construction of pits and trenches, which minimize wastage of material and lessen the amount of labour and equipment needed. Most farms contain suitable sites for trenches, which are essentially shallow pits and which usually can be made with little or no direct outlay.

There should be no avoidable delay in the closing of fields for ensilage. A common error is the making of silage at a later date than is desirable. An important respect in which ensilage is superior to haymaking is that silage usually may be removed early enough to allow of the development of a substantial fresh leafy aftermath before the advent of the customary dry summer period, during which such an aftermath is likely to be particularly valuable.

Further, the material used in early ensilage is likely to be less stemmy than that used in late ensilage, and reduction in stemminess of the material tends to corresponding improvement in quality of the silage—the original material itself is more digestible, and with it the high temperatures of curing which lead to loss of digestibility and of feeding-value generally are more easily avoided.

Frequently it is profitable to dress fields with superphosphate just before closing them for hay or silage, particularly if the fields have not been top-dressed during the preceding twelve months.

Real Value as Basis of buying Seeds.

It seems such simple common-sense to buy comparatively expensive and important lines of seeds on the basis of their content of live seeds of the sort to be sown that it is quite surprising that probably the majority of farmers buy their seeds in what may be termed a "blind" fashion. Farmers should certainly consider it of some significance that seldom can they sell their seeds really advantageously in a similar fashion, and, further, if they are offering really good lines of seeds, they do not desire to sell them in such a fashion — they have nothing to hide, and they desire the prospective purchaser to have dependable evidence of the intrinsic worth of what they are selling. It surely would be strange if this did not operate both ways. The two main matters that seem to be ignored by farmers are—firstly, that the appearance of most seeds is a very incomplete indication of their real value, and, secondly, that farmers, by taking simple suitable steps at the opportune time, may obtain free of cost from the Seed-testing Station of the Department of Agriculture all the information they need about the purity and germination capacity of any lines of seed they contemplate using. In this connection it should be kept in mind that certified seed is not necessarily of good germination or purity, and as certified seed usually is relatively expensive it is particularly advisable to obtain information about the purity and germination of certified seed—exact information is readily available, as it is supplied officially to the owners of the seed at the time of certification.

Forage Crops.

Often satisfactory provision for supplementing the feed directly available from pastures during the critical periods of scant grass-growth cannot be obtained with sufficient certainty by depending upon ensilage and haymaking alone. In dairying the provision of adequate supplies of highly digestible feed in the latter part of the summer is particularly important.

Just how important it is may be gauged by comparing the butterfat-production of 1936 with that of 1935. Because of differences in the seasons, in 1936 there were unusually good supplies of digestible feed in February, whereas in 1935 such supplies were poorer than usual. In February, 1936, the value of the butterfat produced was approximately £500,000 greater than that produced in February, 1935. As the total number of cows milked was approximately equal in each season, and there was no material difference in the composition of the herds, this difference in butterfat-production gives a striking illustration of the influence of feeding.

In dairying, the feed available directly from pastures often becomes inadequate or unsuitable at an earlier date than many seem to realize; frequently such feed is failing shortly after Christmas as a ration for reasonably good dairy stock, although it may suffice for stock of low production. It is relatively easy to rectify this weakness in late January and in February, but it is not so easy to remedy the weak feed position that occurs a little earlier. Fresh leafy growth such as the aftermath from ensilage or the growth from a stand of lucerne is likely to be very useful at this period. If a sufficient supply of such growth is not assured it is usually advisable to sow in October an area of quickly maturing soft turnips, such as Purple Top Mammoth, for use early in the New Year. The yield from such a crop may be somewhat small, but against this must be set the fact that it is specially serviceable in maintaining the production of butterfat until other suitable feed becomes available.

For the winter, crops such as mangels, carrots, swedes, and kales, including chou moellier, are often desirable in addition to silage and hay.

Thorough preparatory cultivation is extremely desirable in all cropping operations. Each year provides much evidence that the possible returns from judicious work and outlay in respect to other phases of cropping are far from fully obtained because of inadequate cultivation.

At times chou moellier has been sown with good results in October, when it may provide feed towards the beginning of February. Later sowings may quite well be made to give feed for use in the autumn and winter. Chou moellier calls for high fertility—it succeeds on soil of the type required for success with cabbage. Hence, if it is desired to grow chou moellier on inferior soils, their fertility should be improved—farm-yard manure being an effective dressing for this purpose. Chou moellier at times replaces swedes with advantage on land which tends to be too wet in winter for the satisfactory feeding-off of swedes. Chou moellier is so resistant to the attacks of club-root, although it is not immune, that it succeeds on land so badly infected with club-root that turnips, swedes, and rape are destroyed on it. A suitable sowing is 1½ lb. to 2 lb. of seed an acre sown broadcast or ½ lb. to ¾ lb. an acre in drills 2 ft. to 3 ft. apart. On good land chou moellier usually responds profitably to a dressing of 2 cwt. to 3 cwt. an acre of superphosphate—a dressing which on poor land generally may be increased with profit. Chou moellier has been used successfully for cows, sheep, pigs, and poultry; it is not looked upon as suitable for fattening lambs after the manner of rape.

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. The potato fares best on a friable soil of high fertility, and partly because of this the crop should be grown, if possible, on land recently ploughed out of old pasture so that the supply of organic matter which begets friability and fertility may be at its maximum.

Great care should be taken to obtain seed which is free from disease. The most serious type of disease—virus—cannot be detected by examination of the tubers. On this account the only safe course generally is to use certified seed—*i.e.*, seed that has been passed under the official system of certification which is administered by the Department of Agriculture, and

which attaches much importance to the amount of virus in the foliage of the parent crop at the time of field inspection. It is known that virus passes from the foliage into the tubers and that the run-out condition of much seed offering is due to virus, for which there is no known effective direct control. In cases in which one line of seed potatoes has given a yield of table potatoes four or five times as great as that from another line of the same variety and under identical conditions, investigation has shown that the large difference in yield was due essentially to virus trouble.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Cultivation.

In all localities where soil conditions permit, cultivation should receive special attention, and every effort should be made to reduce the soil to as fine a tilth as possible. There are but few orchards where, without detriment, cultivation can be dispensed with. An important point which must not be lost sight of is that the season's crop largely depends on the condition in which the soil and trees are kept during the early summer months.

Fertilizers.

It is not too late to apply nitrogenous and phosphatic fertilizers, but the application should not be further delayed.

Grafting.

Grafting should be commenced this month, and in most districts may be continued throughout October, but it is important to remember that to obtain the best results the scions for grafting must be kept in a dormant condition. The buds on the scions should be healthy and plump, and care should be taken that only wood free from disease is used.

Spraying.

Spraying must not be neglected, otherwise the majority of the fruit crops will be unfit for market. Usually at this time of the year showery weather may be expected, which is favourable for the germination of the spores of all fungous diseases.

A close watch must be kept for powdery mildew. Apple and pear trees should be sprayed at petal-fall with lime-sulphur (polysulphide content 15 per cent.) 1–120. To this may be added 2 lb. of colloidal sulphur per 100 gallons. In addition to controlling powdery mildew, this mixture also controls black-spot on apples and pears, providing the spraying programme as set out in the orchard notes for the last month has been carried out.

Where leaf-roller caterpillar is prevalent it will be found advisable to spray apple and pear trees at pink tip with 1½ lb. arsenate of lead powder to 100 gallons of water. This destroys a large number of the first hatching, and therefore makes it more easy to control throughout the remainder of the season. Quite a number of growers neglect to spray for this pest until the fruit is damaged, and in the majority of cases the grub is then protected by fastening a leaf to the apple, or rolling and fastening the leaves loosely together with silken threads into a nest in which they feed.

For the control of codling moth the trees should be sprayed at petal-fall with arsenate of lead powder, 1½ lb. to 100 gallons. This may be combined with lime-sulphur, providing that 3 lb. hydrated lime is added to the mixture in order to assist in preventing leaf scorching or damage to fruit. This should be repeated at three-weekly intervals.

For the control of leaf hopper the trees should be sprayed while the hopper is in the nymph stage, with nicotine sulphate 1–800. This should be repeated in from ten to fourteen days. If the nicotine is not combined with lime-sulphur or arsenate of lead, 3 lb. of soft soap should be dissolved and added.

Ten days after petal-fall apple and pear trees should be sprayed with lime-sulphur 1–180, plus 2 lb. of colloidal sulphur per 100 gallons, to prevent powdery mildew and black spot. This to be repeated at ten-day intervals.

Stone-fruit trees should be inspected carefully for green and black aphis, and immediately either or both of these pests are observed nicotine sulphate (1–800 plus 3 lb. soft soap) should be applied, and repeated in from ten to fourteen days.

For the control of brown-rot spray at fruit set with lime-sulphur (1–80 plus 3 lb. colloidal sulphur), to be repeated in three weeks.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus-culture.

Disease.—If weather conditions have been favourable (that is, excessively moist) to the development of citrus brown-rot, those growers who have not applied a good covering of Bordeaux to their trees would be well advised to again spray thoroughly now with the 3–4–50 formula. An application at this time serves a dual purpose, as apart from being a protection from brown-rot it also serves as a protection to leaves and shoots against infection from verrucosis lesions on mature fruits, leaves, and shoots. Although the main spraying for the control of this disease comes later, the above-mentioned application should not be omitted in groves where verrucosis has been prevalent during the past season. In the use of Bordeaux mixture some growers still adhere to the old formula of 4–4–40, and while in itself there is no harm in this, there is a possibility of uncertainty and confusion arising in the minds of some who see one formula in one publication and a different one in another. To avoid this, the 3–4–50 formula has been adapted generally as standard for all plants in foliage. The main point for growers to keep in mind is not so much the strength of the mixture but the thoroughness with which it is applied combined with correct timing of the application, which all count in securing successful control.

Pruning.—Now that the danger of frosts is practically over, pruning may be attended to. It is not suggested that the pruning of citrus is a regular and extensive task similar to that for deciduous trees, but undoubtedly in many of the older groves there is not sufficient pruning being done. The removal of dead and diseased wood should be undertaken as a matter of course. Efficient growers do not allow this to accumulate in their trees. Apart from wood injured or killed by frost much of the unthrifty wood is pruned out at picking-time. The cause of many of the dead spikes which lead to branch-rubs and scratches is faulty technique by pickers, who often snip off a lemon close to the button and leave on the tree a weakly stub of wood which ultimately dies; if this is not removed it is a potential source of damage to maturing fruits. The approved method of picking fruit is to make the first cut back into healthy wood, and then with the second to trim off the twig from the fruit close to the button. But this, however, is mere routine work. Whether a tree requires special attention by way of a thinning-out of the leaders and a cutting-back of the laterals can be determined only by careful observations made during the course of other orchard operations, particularly picking. For instance, where lemon-trees are not "sizing up" their crop at a normal rate and are colouring their fruit before it is large enough for picking, they may need reinvigorating by hard pruning. It may be necessary to use the saw, and to remove some of the main limbs in order to obtain the desired vigour. Just as with trees of other kinds of fruits, many of the citrus trees are

furnished with too many leaders. These are often so crowded together that it is impossible for a good supply of fruiting laterals to develop. Trees readily fill up the open spaces arising from the thinning out of leaders. Such pruning not only causes the remaining leaders to become stronger, but also is the means of causing a large number of thrifty laterals to be developed, and these in due course should carry heavy crops of good fruit.

Planting Trees.—The most suitable time for planting trees must be determined by the individual grower after due consideration to local conditions. Where it is intended to plant in the early spring, planters should delay until the danger of frosts and of cold winds is over. It is advisable that late spring planting should be done while the soil is still moist to enable the trees to become established quickly without suffering a set-back due to drought. The distance apart at which the trees should be set is at least 25 ft. for lemons and 20 ft. for oranges on the square system. The holes should be prepared before planting-time. The soil should be worked up finely over a wide area and to a good depth. Some organic matter such as cow-manure, sheep-manure, or blood and bone at the rate of 4 lb. per tree should be worked well down and clear of the soil which is to come into direct contact with the roots. On arrival at the orchard the trees should first be cleared of all packing materials and then "heeled in" if planting is not to be proceeded with right away. The roots should not be allowed to become dry. Just prior to planting, the roots should be puddled in mud of a thin consistency and then placed in position in the hole in the proper alignment. The roots should be spread out in a natural position, fine soil should be packed in amongst them by hand in order to separate the roots, and then the remainder of the soil should be spaded in and tramped down firmly. It may be advisable to water occasionally so that the young trees do not suffer from lack of moisture. In cases where trees have been in nursery rows in the orchard they can be lifted with the soil intact around the roots, transported on a sledge to the holes, and planted without serious injury to the roots or set-back.

If the trees arrive in good condition, pruning back of the shoots is unnecessary, but if they suffered in transit a little cutting back and defoliation may be necessary. Where the shape can be improved by a judicious cut or two this may also be done, but it must be borne in mind that with citrus trees one cannot always be sure of getting growth from each and every bud. Little or no pruning should be done to citrus trees until about the third year, when an attempt should be made to develop an open framework of about five sturdy leaders.

Shelter.—Where, in spite of all warnings given to the contrary, trees have been planted out without the provision of adequate shelter-belts, some temporary expedient should be adopted, such as the use of scrim supported by stakes, light brushwood around each tree, or the planting of maize in a couple of rows 6 in. apart. The stalks of the maize remain well into the winter and afford considerable protection.

Cultivation.—This may now be proceeded with. Underneath the spread of the trees the weeds should be removed and the ground lightly hoed. Care should be taken, particularly when a push hoe is used, to see that no damage is done to the trunk of the tree, as any injury is likely to afford entry to bark-blotch organism. The cultivation of the lands between the trees should be done by plough, discs or rotary hoe, according to the method best suited to the district and the implements available. In a citrus grove the initial spring cultivation is often delayed later than that with other fruits, particularly where the cover crop has been sown late in the summer, in order to avoid the necessity of carrying out the main picking-operations in long growth, which on a dewy morning remains wet for a considerable time after picking is possible. With cultivation, as with other operations, the individual grower must use his judgment. Cultivation of the soil in the early summer, and an occasional harrowing to keep the weeds (moisture

robbers) down in the hot summer weather, should be the rule. However, as citrus trees, to maintain their vigour, require organic matter or humus, and excessive cultivation tends to destroy it, this operation should not be overdone, particularly on light sandy soils.

Harvesting.—The rush of other spring work should not be allowed to interfere with the regular picking schedule. A watch should be kept for fruits which have failed to " size up " but have become tree-ripe. These should be removed forthwith.

—A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Overcrowding.

A WEAKNESS that is becoming rather apparent on many plants is that dangerous practice of overcrowding. This fault has been more noticeable, especially during the past year or two, not only on some more or less inexperienced persons' plants but also on some plants run by poultry-keepers with a number of years' practical experience.

Unfortunately, cases of severe losses from colds, roup, &c., have come under notice during the past year, and in quite a number of those cases investigation has shown that the primary cause of the trouble was overcrowding in poorly-ventilated houses. Unless warning is taken and efforts made to check this growing evil, it is feared that some poultry-keepers may have serious losses by trying to rear more stock than the number for which they have accommodation. To begin with, a mistake is at times made by crowding too many eggs into an incubator, or the crowding of too many incubators into a room which is insufficiently ventilated.

The manufacturer of the incubator has made his machine to hold a maximum number of eggs, and ventilation has been arranged for that number, but if the incubator is overcrowded it can hardly be expected to give the best results. It is quite possible that more chickens may actually be hatched from an overcrowded or a refilled machine, but experience has shown that a better class of stock is hatched and a larger percentage of good stock is reared from incubators that are operated a little below rather than above the capacity set down by the maker.

Again, quite a number of troubles and of inferior birds from artificial brooding are due to overcrowding, and the same conditions as mentioned in the preceding paragraph may also apply with regard to the number of day-old chickens placed in such brooder.

As the chickens grow it is advisable to see that they are given plenty of room and more fresh air at night, and that they are graded up regularly.

In practically every hatch there are to be found some birds that do not come on as well as the majority, being shy, more nervous, or having less confidence than the rest, and these are often harassed by the stronger members of the brood, with the result that they do not get sufficient food.

When chickens are overcrowded many culls are often obtained, and untold damage is likely to be done, as the general vitality of the lot is likely to be lowered, and thus the birds made more susceptible to disease. If at all possible it is economical to have a spare brooder on hand and use it for grading-up purposes, as the extra quality and number of birds raised when a regular system of grading-up is practised more than pays for the little extra expense and trouble.

At times when growing stock are overcrowded there results too rapid development, with the result that the birds' constitution, instead of being built up, is weakened, and they are unable to withstand the strain of a long laying period.

Too many poorly-reared pullets are to be seen, many of which do not come on to lay until well into the " flush " season. It is doubtful whether

pullets that do not start to lay until July ever repay what it cost to rear them, and their keep. The rearing of a large number of good pullets successfully is a highly specialized business that requires a great deal of experience, close attention to every detail, and one must ever be on the watch for any sign that indicates unsuitable environment, especially night conditions. The overcrowding of laying-houses has often been the cause of poor egg-production, false moults, or colds amongst stock.

Some poultry-keepers are under the impression that by placing an extra perch in a house that suitable accommodation is being provided for extra birds, but such a practice does not always prove successful. A house 20 ft. long by 20 ft. deep is large enough for 100 laying hens, and one 14 ft. long by 16 ft. deep for 50 birds; in other words, each bird should be allowed 4 sq. ft. floor space. Experience has shown that where less than 4 sq. ft. are allowed each bird the results have not been as good as with the larger space.

When a house is overcrowded it is almost sure to become damp, and dampness in laying-houses must be avoided at all costs. It is well to remember that birds spend a good deal of their time on the perches; therefore, conditions in their roosting quarters must be such that plenty of fresh air is available and a dry atmosphere is provided.

There is a growing tendency amongst successful poultry-keepers not to run more than fifty laying hens together. A little overcrowding during any one stage may not be very noticeable, especially to the inexperienced person, but if the same mistake is made each year there is sure to be a gradual deterioration of the general quality of the flock. Now that the hatching season is here again it is well to consider the great advantage of hatching only the number for which there is ample accommodation, and of aiming for quality and not quantity.

Colds.

A careful watch should be kept at all times on the stock for the first sign of colds. If dust or dirt is seen adhering to the nostrils of a bird it is usually safe to say that that bird is suffering from a cold, and it should be separated from the rest. If possible, the cause should be found: the cause is often compelling young stock to roost in crowded or badly-ventilated houses, and such conditions should of course be corrected. The mouth and nostrils of the affected bird should be washed with warm water containing one teaspoonful of common salt to a quart. The secretion should be removed from the nostrils. If the sides of the head under the eyes are gently massaged before and after it is washed, the secretion is loosened.

For a poultry-keeper living near the sea fresh sea-water is of value for bathing a bird's head if a bird is suffering from a cold. After the mouth and nostrils have been washed as suggested, it is advisable to disinfect those parts with a solution of half hydrogen peroxide and water. All affected birds should be given Epsom salts, about one teaspoonful to each three birds. This can be given twice in a week by being dissolved and mixed in the mash.

Natural Incubation.

September is looked upon as the best month of the year in which to hatch out chickens, especially those of the light breeds. Though many farmers may find it difficult to get broody hens until a little later, every effort should be made to get all chickens hatched before the end of October at the latest, as late-hatched stock does not do well.

Where only a few clutches are required, and if one is not altogether satisfied with the production from the stock on hand, it will be sound economy to spend a few shillings on the purchase of a sitting or two of eggs from a good strain. It will be found that there is as much difference between the laying ability of pullets hatched from stock that have been bred for egg-production and the mongrel-bred pullet as there is in speed between the average hack and a thoroughbred horse.

As many chickens are lost each season from the ravages of insects, it is advisable to see that all broody hens are dusted in order to rid them of insects before they are set. It is not a good practice to set hens in the fowl-house as they are likely to be disturbed by other birds. Better results are usually obtained if the broody hens are set in a coop made for the purpose, and if such coops are placed some distance away from stables or other buildings rats are not so likely to be troublesome.

The hen should be confined to the coop for at least a few days after the hatch comes off, for often there are one or two chickens that hatch out a little later or that may not be quite as strong to start with as the rest, but if such chickens obtain warmth under the hen for a day or so they develop into strong healthy birds, whereas if allowed to roam with the stronger chicks they in many cases are lost. There is no doubt that the easiest way to rear a few chickens is with the mother hen, and given proper facilities the majority of hens make a good job of the business. If at all possible the coop should be placed on fresh ground away from where adult fowls have been running.

It is advisable to feed the chickens at set times: the first feed should be given as early as possible in the morning, and the last just before dusk. It is a mistake to leave wet mash before chicks as it is likely to spoil their appetites.

Milk in all forms is one of the best feeds for growing stock, as it is so easily digested and is a great growth-promoter.

Whether the chicks are being reared with a hen or in a brooder it is well to keep up a regular supply of finely-cut succulent green feed. A person will never regret giving chickens, after the first three or four days, a good variety of green food. Chicks that have had an abundance of green food are in a much better condition to resist disease.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Artificial Feeding.

As advised previously, a strict watch should be kept on the food-supply. As the spring advances this matter becomes of paramount importance. On no account is it advisable to allow the stores to dwindle. The queen's laying-powers are to a large extent automatic—as she is fed so she lays—and when food is abundant brood-rearing is in proportion. Artificial feeding is invariably stimulating, and once undertaken must be carried out regularly and systematically. It is poor policy to fill a hive with brood and then leave it to starve. Spring losses are usually due to lack of stores, and are therefore preventable on the part of the beekeeper. It is advisable to feed sugar syrup only, in the proportion of two parts of water to one of sugar, and to place it in the feeder while slightly warm.

Providing Water.

In the absence of a natural supply, water should be provided. Bees require a good deal of water for brood-rearing throughout the whole season, and it often happens that numbers of bees are lost if water is not close at hand. Moreover, bees often become a nuisance at cattle-troughs and round domestic supplies. Where a large number of colonies are kept it is imperative that the beekeepers see that the bees are well supplied.

Many contrivances are used for the purpose of supplying water. "Simplicity" feeders make excellent vessels for containing water, but they require to be filled frequently and occasionally cleansed. A good contrivance is a kerosene or petrol tin used as follows: Having thoroughly cleansed the tin, punch in the bottom a hole about the size of a sixpence;

through this hole pass a piece of clean rag so that the water falls a drop at a time. Under the tin a container may be placed to catch the water, and this, if filled with sand, affords an excellent watering-place for the bees. The supply can be regulated according to the requirements of the apiary. Bees prefer to take water from damp situations, and they may often be noticed in numbers sucking water from the ground where there has been any overflow. Containers should be placed in a sheltered spot in the apiary.

Foul-brood.

At all times when examining the combs a strict watch should be kept for symptoms of disease. Beekeepers should never lose an opportunity of acquainting themselves with foul-brood in all its stages. At this season, if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspicious, and subjected to the test for foul-brood. If on opening the cell, when a sharp-pointed piece of stick is inserted, the dead imago can be lifted out complete in form, the beekeeper may conclude that if dry it is a case of starvation and if moist of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy ill-smelling mass, it may be concluded that the hive is diseased.

There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvae. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage. The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty, they almost invariably yield a scale if examined, and the hive should be marked for treatment.

There is a deeply rooted notion among beekeepers that foul-brood can be detected outside by the odour, and inexperienced beekeepers are often misled by this statement. However, where the glue-like smell is noticeable from the outside of the hive at a distance of a few feet it may be concluded that the colony is diseased beyond redemption. Fortunately such cases are rare.

Apiary Locations.

Perhaps there is no more important question for the beekeeper than location. Upon his ability to select a suitable district in which to start beekeeping depends his future success. There are few districts in the Dominion where bees cannot be kept in small numbers, but successful establishment of a commercial apiary largely depends upon the beekeeper's knowledge of the nectar-secreting plants. It is generally recognized that the main nectar-flow in New Zealand is produced from white clover and catsear, but it is a distinct advantage if the apiary is established in a district near patches of native bush or where the golden willow is abundant. Most of the indigenous trees and willows flower early, and the nectar from these sources is very valuable to the beekeeper, as it provides ample stores in the spring.

In districts where the beekeeper has to depend entirely upon white clover a careful watch must be kept on the stores, and very often artificial feeding has to be carried on until the appearance of the clover-bloom. This is often expensive, and usually can be avoided by selecting a site where at least a moderate spring flow may be anticipated. The rich dairy pastures of both the North and South Islands, and localities where cattle-raising is carried on extensively, provide suitable sites for commercial apiaries, while country which is used for sheep-grazing is generally not profitable, as the clover pasture is usually eaten bare. Instances have come under notice where abnormal crops have been secured in purely sheep-country, but they

are too infrequent to be taken into consideration, and consequently this class of country should be avoided. Essentially the main requirements are feed and shelter, and if the apiarist is fortunate enough to locate his bees in a position where there is an abundant supply of nectar-secreting plants good shelter can be provided easily.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

OCTOBER is not the least important month of the planting season. Besides completing the sowing of hardy main-crops, the following half-hardy crops are started in most districts—kidney beans, gourds, sweet corn, tomatoes, egg plants, and peppers; also important are the seed-beds of savoy and red cabbage, cauliflower, broccoli, and kale sown for planting out two or three months later to mature during autumn and winter. These crops provide a valuable and varied supply during the summer, autumn, and winter seasons.

To obtain the best results from the half-hardy crops a rich free loam and well-sheltered position is required. Beans and gourds are among the oldest of our vegetable crops. The broad bean, *Vicia faba*, is a hardy native of Europe, which in ancient times was extensively grown; during later years it has been almost entirely displaced by the kidney bean, *Phaseolus vulgaris*, which with so many other useful culinary plants was introduced from South America. Being useful in either a green or dried state makes the kidney bean available over a long period, and thus a vegetable of the first importance. Land well supplied with humus should be given a good dressing of phosphates, and, when the crop is up, a light dressing of nitrate of soda as required. The seed is sown 2 in. or 3 in. deep, 3 in. or 4 in. apart, with 18 in. to 30 in. between the rows.

The gourds have long been esteemed in warm and tropical countries everywhere, especially species of *Cucumis*—cucumbers and melons—and *Cucurbita*—pumpkins and marrows. The marrow, said to be a native of Persia, is the hardiest, and, used in a green state during summer, is an attractive vegetable. The keeping-quality of pumpkins makes them of value in affording variety for winter use. And in many parts of the country the warm season is too short to produce a good crop of cucumbers and melons outside, unless every precaution is taken to start the crop as early as possible. Excellent musk and water-melons are grown in the warmer districts here, and they are crops which could doubtless be extended with advantage. A rich light moist soil and good shelter are the main essentials.

Sweet corn is a variety of the field corn, *Zea Mays*, being distinguished by its high sugar content in its early stages of development and by its translucent kernels when dry. As a summer vegetable it is becoming increasingly popular. It is drilled 3 ft. to 4 ft. apart, and the plants are thinned to 8 in. to 10 in. apart in the drills. Golden Bantam is a popular early dwarf variety, and Stowell's Evergreen and Country Gentleman are vigorous late varieties that are popular. A continuous supply is obtained by sowing early and late varieties; or by sowing an early variety at intervals of two weeks or three weeks. To obtain it in best condition, it should be gathered so soon as the silk withers, as the amount of sugar decreases as the kernels harden.

Egg-plants and red peppers are of tropical origin. They are the last to be taken from the shelter of the frame, and planted out only when warm weather is practically assured. The increasing quantities reaching the market during summer indicate the greater interest taken in these attractive and useful culinary fruits. They are grown satisfactorily only in the warmer localities.

Towards the end of October tomato-plants are planted outside in many districts. In the cooler localities early November is often soon enough. As a good crop can be expected only from good plants every effort should be made to be sure the plants are suitable. Good plants are of a satisfactory strain, young and sturdy, well developed, free from disease, and thoroughly hardened off. In well-prepared ground such plants come away with little trouble under ordinary conditions. A generous dressing of phosphates, usually applied in the form of superphosphate and finely-ground bonedust, and a moderate dressing of sulphate of potash are the chief fertilizer requirements. If the land is rich in organic manure the potash dressing should be correspondingly increased. Under glass this crop is now reaching a stage when the growth is of such dimensions that the amount of air in the house is much reduced, while at the same time the volume of vapour from transpiration is greatly increased. As a result a humid atmosphere is created which often reaches high temperatures—conditions which are most injurious to this crop and should be avoided by providing ample ventilation: in sheltered warm localities this requirement is often very considerable especially if the climate is also generally humid. By such attention at all times now flowers and foliage develop the substance and vigour to properly function and be less likely to suffer from leaf mould and other diseases. In most districts ventilation also at night generally now is necessary.

Small and Sundry Fruits.

Tree tomatoes, Cape gooseberries, and passion vines may now be planted out. These require a relatively warm position to obtain the best results; they are natives of Peru or Brazil. *Cyphomandra betacea*, as the tree-tomato is called by botanists, is a semi-shrub with large soft leaves and grows here to a height of about 6 ft. Its bronze foliage is quite ornamental, as also are its large smooth oval fruits, which ripen in mid-winter. These are generously produced by plants growing in a rich moist loam and well-sheltered position. There is a fairly steady demand for the fruit, which is suited to culinary purposes and makes an attractive dish under good management. A small planting only is usually made, the plants being set about 6 ft. apart.

The Cape gooseberry, *Physalis peruviana*, var. *edulis*, is well established in favour, and might well receive attention for commercial cropping by those who have light land in a warm position. To ripen the full crop before autumn frosts intervene good plants should be set out early and kept growing steadily. A good dressing of phosphates and some sulphate of potash suit them best. The plants may be set 3 ft. apart with 6 ft. between the rows where no support is given. The Cape gooseberry is a perennial herbaceous plant, cut down to the ground by frost in autumn, but when the tops are cleared in early spring and a good dressing of fertilizers is cultivated in they will grow away and produce a second and even a third crop.

The passion vine, *Passiflora edulis*, has received a great deal of attention during recent years, sometimes perhaps too much, but the unique flavour and fragrance it imparts to salads confers a distinction that always makes this fruit popular for that purpose. It is also to be remembered that six or seven years is the extent of the life of a plantation, so that any over-planting which may have been done in some localities is not a very permanent feature.

Although not exacting as to soil conditions, good land is necessary to produce full crops each season over the whole life period of the plantation. Good drainage and shelter are also essential. To enable spraying for the control of disease to be done effectively it is essential that the vines be trained and pruned annually to avoid an accumulation of old unnecessary growth and to maintain a good supply of the new laterals on which the crop is borne.

Plants may be set now 10 ft. apart, at the base of stout stakes and posts standing 5 ft. out of the ground; with a distance of 9 ft. between rows it takes 480 plants to the acre. Two No. 8 galvanized wires, one each side

of the top of the post, and another 3 ft. below them, should be made fast to well-stayed strainer posts, tightened and secured. By stopping laterals after a few leaves have formed growth is concentrated in the leader, which when the top of the post is reached is stopped to make it break into side growths, which are trained along the top wires, and form the bases from which the fruiting-wood springs. Where it is desired to plant passion fruit next season the seeds from selected fruit may now be sown in boxes, pricked out into other boxes later, and grown on in sheltered cradles until required for planting out.

Land for autumn planting in strawberries may now be planted in an early vegetable crop and thoroughly cleaned so that it is ready when required. Where it is intended to plant bush fruits next winter, a main crop of vegetables may be grown now, and a similar routine followed, which secures adequate preparation with economy.

The Homestead Garden.

Few gardens in this country are complete without a liberal display of daffodils to supplement the flowering shrubs during the winter and spring of the year. Rather large groups, each composed of a single variety, planted in the foreground of a shrubbery are perfectly happy with little attention for a few years if they have the vigorous constitution necessary for garden planting. Some of the older varieties have the necessary qualities to fill these requirements admirably, but a great many have been entirely superseded by the fine new seedlings which have been introduced during recent years. These now form a very long list, and, while most of them have the quality which warrants registration, a very much smaller number have, in addition, the vigour which is necessary to warrant them being used for display in the garden borders. To assist planters in making the best selection for this purpose the Royal Horticultural Society has concluded a three-year trial in their Wisley garden and recently published the result in the July number of their Journal. Of the 262 varieties of the newer kinds under trial the ones mentioned below are among those which received the higher awards of merit. The method was to plant twenty-five bulbs of a variety in a clump, the clumps being distributed through a shrubbery border as in an ordinary garden, and to keep them under the supervision of a specially appointed committee. Varieties receiving awards carried from fifty to one hundred blooms in the third year.

The large trumpet varieties were among the earliest to flower: those receiving the higher awards among yellow trumpets were Brandon, Decency, Solferino, Sulphur, Winter Gold, and Wrestler. Of the white trumpets Roxane and Pacific. In bicolor trumpets Mrs. E. C. Mudge.

In the large-bright-cup section (Incomparabilis), Havelock, Ambule, Carlton, Garibaldi, Grenade, Helios, Jubilant, Killigrew, Lucinius, Red Defiance, Smeroe, and Yellow Bird. And with a light perianth, Folly, Eva, Marian Cran, and Warlock.

In the short-bright-cup section (Barii), Dinkie, Nanny Nunn, and Ming.

In the section devoted to white, or whitish, cups large or short (Leedsii), Marmora and Tunis received the highest awards. Others receiving good awards were Cicely, Grayling, Hera, and Mitylene.

Rock gardeners will be interested in the hybrids of *Narcissus triandrus* and *N. cylamineus*. Those of *Narcissus Jonquilla*, which always make a wide appeal with their grace and perfume, include Golden Sceptre, Lanarth, Trevithian, Aurelia, Hesla, and Yellow Prize.

In the section known as Tazetta or Poetaz it comes as no surprise to find Scarlet Gem received the highest award; the clumps bore twenty-six flower stems the first year and seventy-nine in the third year; with the variety Glorious as a very fine second.

Such variety trials are invaluable to planters. By planting the most suitable material in an understanding manner time and money are saved and good results are obtained without delay.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BURNT BONES FOR LAYING-HENS.

G. H. M., Seddon :—

Are burnt bones of value to laying-hens ?

The Live-stock Division :—

Quite a number of poultry-keepers add a small quantity of ground or broken burnt bone to the grit or oyster-shell, which should be within reach of the birds at all times. The broken burnt bones are considered to be useful when hens are laying thin-shelled eggs.

BLOOD COMING FROM UDDER.

L. H., Willowbridge :—

In the milk coming from one quarter, a back one, of each of two cows blood occurs. Could you please inform me the probable cause of this condition ; whether the milk is fit for separation ; what treatment, if any, should be given ?

The Live-stock Division :—

The condition you describe is most frequently brought about by small blood vessels in the udder becoming ruptured owing to the great congestion of the udder with blood, after parturition. Other causes may be bruising of the udder in some way, rough milking by hand, or injury by means of the milking-machine. The act of milking naturally reopens the injury, and until this heals a varying amount of blood will come away, particularly with the strippings. Time alone will remedy the matter, though benefit will be derived by a very careful hand-milking ; do not strip right out ; cease stripping at the first appearance of blood. It is not advisable to put through the separator the milk, which, however, may be fed to pigs or calves without ill effect. With reference to further treatment of the cows, a drench composed of ½ lb. Epsom salts, ½ lb. common salt, and 1 oz. ginger to 1 quart of warm water may be given. If the case does not improve send a sample of the milk to the Officer in Charge of the Veterinary Laboratory, Wallaceville. If you do this the bottle for holding the milk, and also the cork, must be thoroughly cleaned and then boiled for ten minutes to ensure complete sterility.

UTILIZATION OF SUGAR-BEET.

W. E. P., Hunterville :—

Please describe the correct method of harvesting and feeding sugar-beet to dairy stock, and also its value as a food for such stock when used in conjunction with hay.

The Fields Division :—

The time to start lifting sugar-beet can be told by the yellowing or browning off of the lower leaves. Sugar-beet is deep-rooting and, consequently, very difficult to pull, but no information is available of any devices employed in New Zealand to assist in harvesting. In England special implements are used, although it is stated that the roots can be loosened by an ordinary plough, running a small furrow along the rows. The general treatment is much the same as for mangels, and the roots can be stored in a heap covered with straw.

As regards the feeding-value of sugar-beet used in conjunction with hay, such a combination would be more suitable for dry stock, as it is very deficient in protein. The feeding-value of sugar-beet is somewhat higher than that of mangels (although, incidentally, the higher yields and easier harvesting of the latter generally more than compensate) ; approximately 12 lb. of sugar-beet (dry matter 23 per cent.) equals 25 lb. of mangels (dry matter 13 per cent.) or 5 lb. of hay. A ration consisting of about 8 lb. of hay and 24 lb. of sugar-beet per head per day should suffice for maintenance, although, as mentioned above, there

is likely to be a deficiency of protein. The sugar-beet tops are of value, approximately 25 lb. of tops being equivalent to 40 lb. of mangels. They should be fed, however, only after being allowed to wilt for about a week.

RED-WATER IN STOCK.

R. E. C., Frankton Junction :—

Please advise about red-water, which is said to be prevalent among cows being fed on new grass.

The Live-stock Division :—

Certain farms and pastures are notorious for what is called red-water. This is especially true of pasture containing much cocksfoot, and in this country if the soil is of a peaty nature, or is badly drained swamp land, new grass may be associated with this disease, as also may green oats, but not so consistently. Turning cows on to turnips, especially if they have had a touch of frost, or on to roughage such as tall fescue, maize-stalks, and weeds, is conducive to this disease, especially when the cows have not had sufficient hay to make a reasonably balanced ration.

As far as is known from extensive investigation here, the disease is of purely dietetic origin, and is now not so prevalent, owing to animals being better fed and land being better drained and treated.

When this disease appears in a herd, usually several animals are affected, and one of the first symptoms noticed may be the passing of reddish-coloured urine. Animals go off their feed, look sick and dejected, and may suffer from diarrhœa or constipation, and they are very anæmic. In several cases the symptoms become more pronounced and animals may go down and be unable to rise, or they may stand with their heads down, shivering, breathing heavily, and unsteady on their legs. Death takes place in two or three days.

Treatment : Remove animals from feed they are on, give them good hay, and have them in comfortable surroundings. If thought necessary put covers on the sick ones and try feeding them with some crushed oats and bran and salt. Give a ½ lb. each of Epsom salts and common salt dissolved in 4 lb. of black treacle and oatmeal gruel, milk, and eggs, &c., in very bad cases. There is no reason why you should not drench the cow with her own milk. After this, 2 oz. of common salt dissolved in two quart bottles of milk may be given daily as you think best, and discontinued when you wish, according to the progress made. A tonic may be given after. To endeavour to prevent this disease when feeding upon roots, allow a reasonable amount of hay and do not keep animals on the new grass too long. Change them frequently to different feed.

DEPARTMENT OF AGRICULTURE.
WALLACEVILLE POULTRY STATION.

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DAY-OLD CHICKS
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For full particulars apply—
THE POULTRY OVERSEER,
Veterinary Laboratory,
Private Bag to Wallaceville,
WELLINGTON.

WEATHER RECORDS: AUGUST, 1936.

Dominion Meteorological Office.

NOTES FOR AUGUST.

THE month began with unusually widespread snowstorms raging over much of the country, and several days of cold frosty weather followed. Again, at the end of the month, there was a cold snap. The first spell did little damage since, after the 1st, the days were bright and sunny and the snow soon disappeared. In the second there were some losses of lambs, but the ground was too warm for pastures to suffer greatly. Between these two periods the weather was almost continuously mild and spring-like. Grass has grown very quickly for the time of year, and trees, flowers, and shrubs are in an unusually advanced state. White butterflies made their appearance in many districts, and other insects were active. Birds are already showing signs of mating. Stock are doing well, and the lambing-season has, so far, been a good one. Feed is plentiful. In western districts and Marlborough a spell of dry, sunny weather would be now welcomed.

Rainfall.—Most of the east coast of the North Island and a strip extending across from Hawke's Bay to Wanganui had less than the average rainfall. The same was the case with areas about the borders of Canterbury and Marlborough and Canterbury and Otago. The rest of the country had more than the average. Over the western half of the South Island the falls averaged at least double the normal for August.

Temperatures.—The month was one of the warmest Augusts on record. Temperatures were everywhere above normal, the average departure being over 2° F. Following the snow at the beginning of the month some severe frosts occurred.

Sunshine.—The total amount of bright sunshine was slightly above normal over most of the eastern districts of the South Island, but elsewhere was below. Unusually cloudy conditions were experienced in all western districts. Napier had 169·6 hours and Tauranga 161·4.

Pressure Systems.—Cold, strong southerly winds were blowing on the 1st, and snow was falling in many places, especially in eastern districts, following the passage eastward of a deep depression. The snow lay to unusually low levels, about Wellington particularly. Anticyclonic weather with sunny days and sharp frosts at night then prevailed until the 4th.

From the 5th to the 17th a series of westerly depressions continued to cross the southern portion of the Dominion. Winds from between north and west persisted and were often strong. There was frequent heavy rain in western and northern districts, but comparatively little east of the ranges. Temperatures were remarkably mild. On the 7th, after the passage of the first depression of the series, snow was widespread on the high levels.

An anticyclone then crossed the northern part of the country, and, after moving south-eastwards, became very intense and almost stationary, with its centre in the neighbourhood of Chatham Islands. It was not until the 26th that the anticyclone finally began to give way. Northerly winds and warm weather prevailed most of the time. There were general rains with many heavy falls, though districts from Canterbury southwards escaped lightly.

On the 28th a depression appeared over the Tasman Sea. Developing into a deep cyclone, it crossed the South Island on the night of the 29th. This storm caused the heaviest and most general rains of the month, and the southerly gales in rear of it brought cold weather, with hail and snow in many places. There were also some thunderstorms.

RAINFALLS FOR AUGUST, 1936, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	6·43	15	1·95	5·12	40·89	38·76
Russell	7·70	13	2·78	4·70	71·81	37·30
Whangarei	7·94	17	2·38	6·31	49·44	45·10
Auckland	8·28	18	2·98	4·61	38·88	34·47
Hamilton	4·24	20	0·90	4·11	37·43	33·11
Rotorua	5·11	18	1·42	4·91	47·50	36·76
Kawhia	6·61	13	1·29	4·63	41·59	36·18
New Plymouth ..	6·87	23	1·63	5·49	41·45	40·41
Riversdale, Inglewood ..	12·22	25	2·00	8·89	67·63	67·60
Whangamomona ..	6·72	15	1·43	6·02	49·72	48·99
Hawera	4·93	18	0·96	4·50	31·87	30·11
Tairua	3·70	19	0·81	5·84	39·17	45·71
Tauranga	4·38	19	1·53	4·30	42·42	36·12
Maraehako Station, Opotiki	10·66	18	2·72	5·49	49·83	37·73
Gisborne	2·43	10	0·90	4·33	34·74	34·29
Taupo	4·64	22	0·87	4·07	36·06	29·30
Napier	1·19	12	0·44	2·95	38·83	22·30
Hastings	1·18	12	0·37	3·13	33·85	23·42
Whakarara Station ..	1·74	8	0·83	..	..	42·16
Taihape	1·70	22	0·44	2·74	31·70	23·52
Masterton	3·13	15	1·25	3·59	36·27	26·54
Patea	4·01	21	0·77	3·81	34·24	29·44
Wanganui	2·21	14	0·35	2·81	29·04	23·85
Foxton	5·07	19	1·02	2·95	29·31	21·33
Wellington	4·68	20	1·77	3·93	40·51	29·67
	South Island.					
Westport	14·44	25	1·40	7·70	52·12	62·50
Greymouth	15·09	25	2·33	7·48	58·07	64·97
Hokitika	19·67	27	2·62	9·24	63·99	73·29
Ross	21·47	24	2·20	10·43	73·33	82·38
Arthur's Pass ..	17·95	21	2·75	10·20	78·27	96·07
Okuru, South Westland	21·82	20	2·10	11·24	94·13	93·80
Collingwood	16·29	22	3·13	7·11	65·19	62·09
Nelson	8·84	15	2·33	3·06	28·17	24·86
Spring Creek, Blenheim	4·71	14	2·37	2·75	26·03	20·64
Seddon	3·10	10	1·78	1·90	20·93	16·62
Hanmer Springs ..	2·04	10	0·58	3·42	39·30	29·48
Highfield, Waiau ..	1·31	7	0·47	2·45	28·29	22·53
Gore Bay	1·07	5	0·47	2·64	27·14	21·31
Christchurch	2·29	11	0·83	1·82	25·59	16·99
Timaru	0·87	7	0·56	1·45	21·97	14·43
Lambrook Station, Fairlie	1·23	10	0·39	1·53	19·24	16·13
Benmore Station, Clearburn	2·52	12	0·97	1·48	16·03	16·02
Oamaru	1·17	8	0·34	1·74	18·79	14·44
Queenstown	4·47	18	0·90	2·05	22·93	19·43
Clyde	1·23	10	0·29	0·79	9·27	9·45
Dunedin	3·52	10	1·09	3·07	31·45	24·13
Wendon	2·08	10	0·52	2·05	19·51	19·27
Balclutha	2·28	17	0·50	1·78	20·99	16·27
Invercargill	4·20	21	0·68	3·20	30·18	29·78
Puysegur Point ..	9·72	28	0·91	6·94	57·46	55·35
Half-moon Bay ..	6·64	21	0·84	4·39	32·74	37·92

LIVE-STOCK IN NEW ZEALAND, 1936.

UNLESS OTHERWISE SPECIFIED, ENUMERATED AT 31ST JANUARY.

Land District.	Horses as at 31st Jan., 1936.	Dairy Cows as at 31st Jan., 1936 (in Milk and Dry).	Total Cattle as at 31st Jan., 1936 (including Figures in previous Column).	Number of Sheep shorn, Season 1935–36.	Number of Lambs shorn, Season 1935–36.	Number of Lambs tailed, Season 1935–36.	Total Sheep (including Lambs) as at 30th April, 1936.*	Pigs as at 31st Jan., 1936.
North Auckland	30,329	381,465	680,896	973,669	193,482	528,895	1,069,488	151,223
Auckland ..	45,421	620,575	1,059,138	1,659,005	381,297	1,083,653	1,851,410	279,144
Gisborne ..	13,017	56,009	343,996	2,166,620	713,000	1,024,778	2,351,646	25,248
Hawke's Bay ..	16,670	75,614	341,628	3,528,322	639,878	2,043,007	4,074,414	27,779
Taranaki ..	17,436	264,487	435,775	891,036	238,420	530,764	915,841	91,970
Wellington ..	35,109	261,895	751,489	5,569,202	1,371,391	3,288,978	6,135,047	110,404
Nelson ..	5,507	35,082	71,021	382,816	14,293	175,381	439,542	18,283
Marlborough ..	5,765	16,292	40,769	1,029,128	19,236	475,180	1,133,510	7,494
Westland ..	2,143	16,427	46,670	68,116	6,766	55,224	77,817	7,213
Canterbury ..	51,258	82,137	176,858	4,531,177	30,759	2,976,738	5,544,583	50,972
Otago ..	29,720	60,984	138,129	3,342,333	5,535	1,904,007	3,875,123	22,011
Southland ..	23,795	80,540	167,709	2,137,053	4,591	1,610,012	2,570,712	16,722
Totals, 1936	276,170	1,951,507	4,254,078	26,278,477	3,618,648	15,696,617	30,039,133	808,463
Totals, 1935	272,986	1,952,094	4,293,499	25,639,654	3,529,202	15,689,492	29,076,754	762,755

* 1936 figures are interim only.

—Census and Statistics Office.